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PROGRAM AND ABSTRACTS OF THE TWENTY-FIFTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS, CLEVELAND, OHIO

December 27, 28, 29, 1950

PROGRAM[1]

WEDNESDAY MORNING SESSION, DECEMBER 27, 9:00 AM, HOTEL HOLLENDEN, PARLORS A & B.

Read

1. The Epidemiology of Schistosome Dermatitis ("Koganbyo") in Japan. (10 min) G. W. HUNTER, III, AND L. S. RITCHIE, 406th Medical General Laboratory, Tokyo; H. TANABE, Okayama Medical School, Okayama, Japan.

2. Skin Testing for Schistosomiasis Japonica with Antigens from Adult Worms and Cercariae of *S. japonicum*. (10 min) G. W. HUNTER, III, L. S. RITCHIE, C. PAN AND S. S. LIN, 406th Medical General Laboratory, Tokyo; M. YOKOGAWA, National Institute of Health, Tokyo; AND S. SUGIURA.

3. Development of *Schistosoma mansoni* in the Peritoneal Cavity of Mice. (10 min) DONALD V. MOORE AND HENRY E. MELENEY, New York University, College of Medicine.

4. Progressive Blood Changes in Experimental Infections with *Schistosoma mansoni* in Mice. (10 min) (Lantern) ELOISE B. CRAM, National Institutes of Health.

5. Eosinophil Response of Mice to Single Sex and Mixed *Schistosoma japonicum* Infections. (10 min) (Lantern) WILLIAM B. DE WITT, National Institutes of Health (Introduced by P. P. Weinstein).

6. Some Characteristics of Early Schistosome Infections in Mice. (15 min) (Lantern) LOUIS OLIVIER, National Institutes of Health.

7. Development of the Mother and Daughter Sporocysts of a Snake Plagiorchiid, *Lechriorchis primus*. (15 min) (Lantern) (Also by Demonstration) W. W. CORT, The Johns Hopkins University; D. J. AMEEL, Kansas State College; ANNE VAN DER WOUDE, University of Michigan.

8. Germinal Development in the Early Stages of the Mother Sporocyst and Rediae of *Paragonimus kellicotti*. (15 min) (Lantern) D. J. AMEEL, Kansas State College; W. W. CORT, The Johns Hopkins University; ANNE VAN DER WOUDE, University of Michigan.

9. Germ Cell Cycle of *Megalodiscus temperatus* (Stafford, 1905) Harwood, 1932. (15 min) (Lantern) ANNE VAN DER WOUDE, University of Michigan.

[1] An alphabetical author index will be found at the end of the program. Extra copies of this supplement, and portraits of parasitologists, will be on sale at the meeting.

10. Germ Cell Cycle of *Echinostoma revolutum* (Froelich, 1802). (10 min) (Lantern) HELEN M. CHURCHILL, Hollins College.

11. The Life History of *Neoleucochloridium problematicum* (Magath, 1920) new comb. (Trematoda: Brachylaemidae). (15 min) (Motion Picture, Lantern) IRVING G. KAGAN, The University of Chicago.

12. Contributions to the Life History and Morphology of *Gynaecotylea adunca* (Linton, 1905). (10 min) (Lantern) WANDA S. HUNTER, Duke University.

13. New Species of Rhopalocercous Cercariae. (15 min) (Lantern) (Also by Demonstration) JACOB H. FISCHTHAL, Harpur College, State University of New York, Endicott.

14. Resistance of Fowls to Parasitism Affected by Female Sex Hormone. (5 min) (Lantern) J. E. ACKERT AND L. W. DEWHIRST, Kansas State College.

15. Further Studies on the Tissue Phase of the Life Cycle of *Ascaridia galli.* (10 min) R. L. TUGWELL, University of Tennessee AND J. E. ACKERT, Kansas State College.

16. Relationships of Aging, Food Reserves, and Infectivity of Some Ascarid Larvae. (8 min) D. J. AMEEL, Kansas State College; ALICE ELLIOTT, Kansas State Teachers College; J. E. ACKERT, Kansas State College.

By Title

17. Parasitological Studies in the Far East. V. An Epidemiologic Survey in Okayama Prefecture, Honshu, Japan. L. S. RITCHIE, G. W. HUNTER, III, E. H. KAUFMAN, C. PAN, 406th Medical General Laboratory; K. NAGANO, Kitasato Institute; M. YOKOGAWA, National Institute of Health, Tokyo. (With the Technical Assistance of J. I. SZEWCZAK, Y. HISHINUMA AND S. ASAKURA, 406th Medical General Laboratory.)

18. Parasitological Studies in the Far East. X. An Epidemiologic Survey on Hokkaido, Japan. L. S. RITCHIE, G. W. HUNTER, III, C. PAN, 406th Medical General Laboratory; M. YOKOGAWA, National Institute of Health, Tokyo. (With the Technical Assistance of J. MCCONNAUGHEY, Y. HISHINUMA, L. MUNIZ, AND C. KNOX, 406th Medical General Laboratory.)

19. Parasitological Studies in the Far East. XI. An Epidemiologic Survey of Okinawa. G. W. HUNTER, III, L. S. RITCHIE, C. PAN AND S. LIN, 406th Medical General Laboratory. (With the Technical Assistance of J. N. MCCONNAUGHEY, R. L. MCCLEARY AND C. B. KNOX, 406th Medical General Laboratory.)

20. The Distribution of the Snail Intermediate Host of *Schistosoma japonicum* (*Oncomelania nosophora*) along the Tone River, Japan. L. S. RITCHIE, G. W. HUNTER, III, C. PAN, 406th Medical General Laboratory; K. NAGANO, Kitasato Institute. (With the Technical Assistance of J. N. MCCONNAUGHEY, C. B. KNOX, Y. HISHINUMA, S. ASAKURA AND M. SHIMIZU, 406th Medical General Laboratory.)

21. Parasites of the Goldeye, *Amphiodon alosoides,* in Lake Texoma. J. TEAGUE SELF, University of Oklahoma.

22. Life History Contributions to the Subfamily Ochetosomatinae Leão, 1944 (Reniferinae Pratt, 1902). JOHN D. GOODMAN, University of Michigan.

23. *Gigantobilharzia huronensis* sp. nov., A Bird Blood-fluke from the Goldfinch. ABBAS T. NAJIM, University of Michigan.

24. Revision of the Subfamily Leucochloridiinae (Trematoda: Brachylaemidae). IRVING G. KAGAN, The University of Chicago.

25. Erratic Hirudiniasis in a Lake Trout (*Cristivomer namaycush*). MARVIN C. MEYER, University of Maine AND RALPH V. BANGHAM, The College of Wooster.

26. A New Secondary Intermediate Host for *Postharmostomum helicis* (Trematoda: Brachylaemidae). MARTIN J. ULMER, Iowa State College.

27. *Brachylaima rauschi* n. sp. from an Arctic Lemming, *Dicrostonyx groenlandicus rubricatus* (Richardson, 1839). ALLEN MCINTOSH, Bureau of Animal Industry.

WEDNESDAY AFTERNOON SESSION, DECEMBER 27, 2:00 PM, HOTEL HOLLENDEN, PARLORS A & B.

Read

28. Substance Testing and the Physical Composition of *Endamoeba histolytica* Cultivation Medium. (10 min) (Lantern) E. CLIFFORD NELSON, Medical College of Virginia.

29. The Effect of Dietary Ascorbic Acid Deficiency on the Susceptibility of Guinea-pigs to Infection with *Endamoeba histolytica*. (15 min) (Lantern) ELVIO H. SADUN, Tulane University.

30. The Effect of Dietary Carbohydrate on *Endamoeba histolytica* Infections in the Rat. (15 min) (Lantern) JOSEPH GREENBERG AND D. JANE TAYLOR, National Institutes of Health.

31. Chemotherapy of *Endamoeba histolytica* Infections in the Rabbit. (15 min) (Lantern) GEORGE W. LUTTERMOSER, W. T. HASKINS, NELL COLEMAN AND JOHN R. JUMPER, National Institutes of Health.

32. Transfaunation Studies on the Host-Specificity of the Enteric Protozoa of Rodents. (15 min) (Lantern) L. H. SAXE, University of Pennsylvania and The State University of Iowa.

33. A Survey of Blood Parasites in Domestic Animals in South Carolina. (10 min) FLOYD O. ATCHLEY, The Communicable Disease Center and State Board of Health of South Carolina.

34. Natural and Artificial Infections with *Leucocytozoon simondi* Mathis and Léger in Ducks. (10 min) (Lantern) A. MURRAY FALLIS, DOUGLAS M. DAVIES AND MARJORIE VICKERS, Ontario Research Foundation, Toronto.

35. The Relapse Phenomenon in *Leucocytozoon simondi* Infections in Domestic Ducks. (15 min) (Lantern) ELI CHERNIN, The Johns Hopkins University.

36. The Mosquito Transmission of the 1P Strain of *Plasmodium relictum* to Pigeons. (15 min) W. B. REDMOND, Emory University.

37. The Position of Protective and Sparing Factors in the Protein Component of the Plasma of Ducks Recovered from *Plasmodium lophurae* Infection. (10 min) (Lantern) ELERY R. BECKER AND THOMAS M. SCHWINK, Iowa State College.

38. The Response of *Plasmodium malariae* Infections to Metachloridine, Chlorguanide (Paludrine) and Intramuscular Chloroquine. (10 min) (Lantern) SOL B. MCLENDON, South Carolina State Hospital; MARTIN D. YOUNG, National Institutes of Health.

39. Results of Placing *Trichomonas gallinae* from Mourning Doves into Clean Domestic Pigeons. (10 min) (Lantern) ROBERT M. STABLER, Colorado College and Colorado Game and Fish Department (collaborator).

40. Structure and Morphogenesis of *Trichomonas prowazeki* Alexeieff and *Trichomonas brumpti* Alexeieff. (15 min) (Lantern) B. M. Honigberg, University of Massachusetts.

41. A New Trypanosome, *Trypanosoma pipientis* n. sp. from the Leopard Frog, *Rana pipiens*. (15 min) (Lantern) Louis S. Diamond, University of Minnesota.

By Title

42. Action of Prodigiosin on Protozoa. Oscar Felsenfeld, George W. Mast and Sachiko J. Ishihara, Hektoen Institute for Medical Research.

43. Experimental Amebiasis in Rats with Cultivated Cysts. Max C. McCowen and John F. Lawlis, Jr., The Lilly Research Laboratories.

44. Blood Parasites in Colorado Band-tailed Pigeons. Robert M. Stabler and Phyllis Sundquist Limberg, Colorado College and Colorado Game and Fish Department (collaborator); Clyde P. Matteson, Colorado Game and Fish Department.

45. Incidence of *Trichomonas gallinae* in Colorado Mourning Doves and Band-tailed Pigeons. Robert M. Stabler, Colorado College and Colorado Game and Fish Department (collaborator); Clyde P. Matteson, Colorado Game and Fish Department.

46. The Experimental Infection of Young Monkeys (*Macacus rhesus*) with Human Strains of *Entamoeba histolytica*. M. J. Miller, Institute of Parasitology, Macdonald College (Introduced by T. W. M. Cameron).

47. The Effect of Centrifugalization on the Survival, Reproduction and Infectivity of *Endamoeba histolytica* trophozoites. D. E. Wykoff, MSC, USA, Tulane University (Introduced by E. C. Faust).

48. The Effect of Intestinal Infections with *Endamoeba histolytica* on the Liver and Spleen and on the Tissue Distribution of Ascorbic Acid in Normal and Vitamin-C-deficient Guinea-pigs. Guillermo M. Carrera, Elvio H. Sadun and John L. Bradin, Jr., Tulane University.

Wednesday Evening, December 27, 7:00 PM, Hotel Hollendon, Parlor G. Dinner and business meeting, officers and members of the Council.

Thursday Morning Session, December 28, 9:00 AM, Hotel Hollenden, Parlors A & B.

Symposium

Host-Parasite Relationships among the Helminths

49. Host-parasite Relationships among the Digenetic Trematoda. (30 min) (2″ × 2″ Lantern) George R. LaRue, University of Michigan.

50. Host-parasite Relationships in Cestode Infections, with Emphasis on Host-resistance. (30 min) (Lantern) John E. Larsh, Jr., University of North Carolina.

51. Evolution of Zooparasitic Groups in the Phylum Nematoda, with Special Reference to Host-distribution. (30 min) (Lantern) Ellsworth C. Dougherty, University of California.

Commemoration of Twenty-fifth Anniversary

(30 min) (Lantern) W. W. Cort and Eloise B. Cram

Presidential Address

52. Medical Parasitology in a Changing World. What of the Future? (45 min) WILLARD H. WRIGHT, National Institutes of Health.

THURSDAY, DECEMBER 28, HOTEL HOLLENDEN, BALLROOM, E. HALF. 1:00 PM, Annual Luncheon and Business Meeting.

THURSDAY AFTERNOON SESSION, DECEMBER 28, 2:45 PM, BIOLOGY BUILDING, WESTERN RESERVE UNIVERSITY. Joint-Program with the American Society of Zoologists.

By Demonstration

7. Development of the Mother and Daughter Sporocysts of a Snake Plagiorchiid, *Lechriorchis primus*. (Also read) W. W. CORT, The Johns Hopkins University; D. J. AMEEL, Kansas State College; ANNE VAN DER WOUDE, University of Michigan.

13. New Species of Rhopalocercous Cercariae. (Also read) JACOB H. FISCHTHAL, Harpur College, State University of New York, Endicott.

53. Life History of a Gorgoderid Trematode from *Rana clamitans*. J. STEGER HUNT, University of Michigan.

54. An "Acanthocolpid" Trematode from the Sturgeon of the Wabash River. R. M. CABLE, Purdue University.

55. Studies on the Biology of *Acetodextra amiuri* (Stafford, 1900) (Trematoda: Heterophyidae). KENNETH W. PERKINS, Purdue University.

56. Sporocyst of *Echinostoma revolutum* (Froelich, 1802). HELEN M. CHURCHILL, Hollins College.

57. A New Genus and Species of Caryophyllaeidae (Cestoda) from Fishes. JACOB H. FISCHTHAL, Harpur College, State University of New York, Endicott.

58. A Precociously Developed Brachylaemid Metacercaria within a Sporocyst. MARTIN J. ULMER, Iowa State College.

59. Germ Cell Cycle in the Trematode Family Brachylaemidae. ARTHUR E. WOODHEAD, University of Michigan.

60. Artefacts and Exoerythrocytic Stages of *Plasmodium cynomolgi* in *Macaca mulatta*. FREDERICK COULSTON AND FRANCES O. ROBINSON, The Christ Hospital Institute of Medical Research.

61. Observations on the Life History of *Ascaris columnaris* J. F. A. SPRENT, Ontario Research Foundation, Toronto.

62. An American Host Record for the Russian Sturgeon Nematode, *Cystoopsis acipenseri* Wagner, 1868. M. B. CHITWOOD AND ALLEN MCINTOSH, Bureau of Animal Industry.

63. The Early Developmental Stages of *Onchocerca volvulus* in Guatemalan Species of *Simulium*. COLVIN L. GIBSON, National Institutes of Health and Pan American Sanitary Bureau, Guatemala.

64. The Distribution of Alkaline Glycerophosphatase in the Muscle of Rats Infected with *Trichinella spiralis*. W. L. BULLOCK AND D. P. GANGI, University of New Hampshire.

65. Some Odd Scolecidans. B. G. CHITWOOD, Catholic University of America.

66. The Life-Cycle of *Monoecocestus sigmodontis* (Cestoda: Anoplocephalidae)

from the Cotton Rat (*Sigmodon hispidus*). DOROTHY M. MELVIN, The Rice Institute.

67. A Vole (*Microtus*) an Important Natural Intermediate Host of *Echinococcus granulosus*. EVERETT L. SCHILLER AND ROBERT RAUSCH. Arctic Health Research Center, Anchorage.

69. Studies on the Host-Parasite Relations of *Hymenolepis nana* var. *fraterna*. (Also read) W. S. BAILEY, Alabama Polytechnic Institute.

70. Characters for Distinguishing the Sexes of Live Tropical Rat Mites in Various Stages of Development. J. ALLEN SCOTT AND ELLEN BLYNN, University of Texas Medical Branch.

71. An Instrument for Microscopic Examination of Objects in Closed Vessels. JORDAN LEFLER AND PAUL V. GUSTAFSON, University of Washington.

72. Preliminary Observations on the Occurrence of Water-mites on Insects in the Duke Forest. (Also read) R. M. CROWELL, Duke University.

73. Distribution and Host Relationships of a Mite Parasitic in Fresh-water Clams. ARTHUR G. HUMES, Boston University; HUGO A. JAMNBACK, University of Massachusetts.

74. The Life Cycle and Parasitic Habit of the Chigger Mite *Hannemania dunni* Sambon, 1928, a Parasite of Amphibians. K. E. HYLAND, Duke University.

113. Some Anomalies Observed in Developmental Stages of the Diphyllobothriidae. (Also read) D. L. DE GIUSTI, Wayne University.

FRIDAY MORNING SESSION, DECEMBER 29, 9:00 AM, HOTEL HOLLENDEN, PARLORS A & B.

68. Parasitic Turbellarians from Echinoderms. (10 min) H. W. STUNKARD AND J. O. CORLISS, New York University.

Read

72. Preliminary Observations on the Occurrence of Water-mites on Insects in the Duke Forest. (Also by Demonstration) (6 min) (Lantern) ROBERT M. CROWELL, Duke University.

75. Studies on the Life History and Pathogenicity of the Intestinal Nematode, *Strongyloides papillosus* in Calves. (15 min) (2″×2″ Lantern) HALSEY H. VEGORS AND DALE A. PORTER, U. S. Bureau of Animal Industry.

76. The Role of the Protein Coat in the Development of the Ova of *Ascaris lumbricoides* var. *suum*. (15 min) (Lantern, Opaque Projection) B. J. JASKOSKI, Notre Dame University and The Creighton University (Introduced by J. D. Mizelle)

77. An Outbreak of Parasitic Gastroenteritis in Feedlot Lambs. (15 min) B. SCHWARTZ, A. O. FOSTER, J. E. PETERMAN, J. L. WILBER, JR., AND K. C. KATES, U. S. Bureau of Animal Industry.

78. A Description of the Larval Stages of *Litomosoides carinii* Occurring in the Intermediate Host. (10 min) (Lantern) J. ALLEN SCOTT, University of Texas Medical Branch.

79. Filariasis in American Samoa I. Persistence of Microfilariae in Individuals not Exposed to Reinfection. (10 min) (Lantern) LEO A. JACHOWSKI, JR., Naval Medical Research Institute; GILBERT F. OTTO, The Johns Hopkins University; JAMES D. WHARTON, Naval Medical Research Institute.

80. Isolation Cultures of *Neoaplectana glaseri.* (10 min) V. H. Dropkin, Roosevelt College.

81. The Effect of Some Iodine Compounds on Horse Strongyle Larvae in Manure. (10 min) (Lantern) Norman D. Levine, University of Illinois.

82. Results of Additional Experiments in which Small Amounts of Phenothiazine was Fed in Pure Infections of the Nodular Worm in Calves. (10 min) (Lantern) R. L. Mayhew, Louisiana State University.

83. A Preliminary Report on Feeding Small Amounts of Phenothiazine during the Prepatent Period in Pure Infection of the Nodular Worm in Calves. (5 min) (Lantern) Roy L. Mayhew, Louisiana State University.

84. The Use of Sulfonamides for the Control of Trichinosis in White Mice. (10 min) (Lantern) Bernard B. Riedel, Southwestern College.

85. Lymphocystis Disease and Ergasilid Parasites in Fishes. (15 min) (Lantern) Ross F. Nigrelli, New York Aquarium.

86. Some Pathogenic Effects of Gregarines on their Hosts. (15 min) (Lantern) G. H. Ball, University of California at Los Angeles.

87. Studies on the Transmission of *Toxoplasma gondii.* (15 min) (Lantern) Leon Jacobs, Paul A. Woke and Frances E. Jones, National Institutes of Health.

88. Acid Phosphatase Staining Reactions in Intestinal Amoebae. (8 min) (Lantern) William Balamuth, Northwestern University.

89. Experiments on Excystation and Growth of *Endamoeba histolytica* and *Endamoeba coli.* (15 min) (Lantern) Charles W. Rees, National Institutes of Health.

By Title

90. Studies on Infections of a Caecal Worm, *Paraspidodera uncinata,* in Guinea Pigs. W. D. Lindquist and D. J. Hitchcock, Michigan State College.

91. Oxygen Consumption Related to Oxygen Tension in *Rhabditis strongyloides* and other Nematodes. Thomas D. Bair, Utica College of Syracuse University (Introduced by Lyell J. Thomas).

92. Deficiencies of Certain Minerals as Factors in Resistance of Chickens to Parasitism. S. M. Gaafar, Fouad I University, and J. E. Ackert, Kansas State College.

93. *Protostrongylus rufescens* in Domestic Sheep, *Ovis aries,* in the United States. Charles Durbin, Bureau of Animal Industry.

94. An Improved Method for the Complete Elimination of Microorganisms from *Ascaris lumbricoides.* Donald Fairbairn, Institute of Parasitology, Macdonald College, Quebec. (Introduction by T. W. M. Cameron)

95. Observations on the Path of Larvae of *Strongyloides agoutii* in the Guinea Pig and the Effectiveness of the Method of Inoculation. Michael R. Reesal, Institute of Parasitology, Macdonald College, Quebec. (Introduced by T. W. M. Cameron).

96. The Effect of Oral DDD (TDE) on Natural Resistance of Mice to Infection with *Trichinella spiralis.* Charles Baughn, University of North Carolina.

97. The Effect of Body Weight on the Natural Resistance of Mice to *Trichinella spiralis.* James R. Hendricks, University of North Carolina.

98. Studies on the Life Cycle of *Physaloptera rara* Hall and Wigdor, 1918, and

Physaloptera praeputialis Linstow, 1889. L. H. Petri; D. J. Ameel, Kansas State College.

99. Parasites of the Brevicipitidae (Amphibia). A. C. Walton, Knox College.

100. Parasites of the Amphibia. Nematoda I. A. C. Walton, Knox College.

101. Parasites of the Amphibia. Nematoda II. A. C. Walton, Knox College.

Friday Afternoon Session, December 29, 2:00 PM, Hotel Hollenden, Parlors A & B.

Read

102. Studies on Experimental Chagas' Disease in Mice in Relation to Chemotherapeutic Testing. (15 min) (Lantern) Frans C. Goble, Sterling Winthrop Research Institute.

103. The Respiration of Trypanosome-infected Rats. (12 min) (Lantern) Theodore von Brand, National Institutes of Health.

104. Carbohydrate Metabolism in Chickens Infected with *Eimeria tenella.* (10 min) (Lantern) Jack W. Daugherty, University of Wisconsin.

105. The Effect of Cecal Coccidiosis on the Metabolic Rate of Chickens. (12 min) (Lantern) C. A. Herrick, University of Wisconsin.

106. Some Relationships between the Respiratory Rate of Cecal Mucosa and Resistance of Chickens to Cecal Coccidiosis. (12 min) (Lantern) C. A. Johnson and C. A. Herrick, University of Wisconsin.

107. Coccidiosis of the Turkey. (15 min) (Lantern) Philip A. Hawkins, Michigan State College.

108. The Effect of Nitrofurazone on Normal and Coccidiosis Infected Turkeys. (15 min) Earl N. Moore and J. A. Brown, New York State Veterinary College.

109. The Genus *Corallobothrium* from Catfishes in Lake Texoma, Oklahoma, with a Description of Two New Species. (15 min) (Lantern) Kermit E. Sneed, University of Oklahoma and Oklahoma Fisheries Research Laboratory (Introduced by J. T. Self.)

110. Parasites of 17 Species of Sharks from the Gulf of Mexico. (5 min) Aaron Seamster, Del Mar College; Jack Baughman, Texas Game, Fish and Oyster Commission.

111. Experiments on the Nutrition and Host Relations of *Hymenolepis diminuta* in White Rats, with Special Reference to Vitamins and Hormones. (15 min) (Lantern) J. Walter Beck and Asa C. Chandler, Rice Institute.

69. Studies on the Host-parasite Relations of *Hymenolepis nana* var. *fraterna.* (Also by Demonstration) (15 min) (Lantern) W. S. Bailey, Alabama Polytechnic Institute.

Studies on the Ecological and Morphological Relationships of Diphyllobothriidae to Fish and Fish-eating Birds. Lyell J. Thomas, Dominic L. De Giusti, and Kathleen L. Hussey:

112. (I) Ecological Relationships of Tapeworms (Diphyllobothriidae) to the Infection of Fish and Fish-eating Birds of the Great Lakes Region. (15 min) (Lantern) Lyell J. Thomas, University of Illinois and University of Michigan Biological Station.

113. (II) Some Anomalies Observed in Developmental Stages of the Diphyllo-

bothriidae. (Also by Demonstration) (15 min) (Lantern) DOMINIC L. DE GIUSTI, Wayne University.

114. (III) A Comparative Study of the Coracidia and Procercoids of Pseudophyllideans of the Great Lakes Region. (15 min) (Lantern) KATHLEEN L. HUSSEY, Columbia University.

By Title

115. Effects of a Pure Infection of the Tapeworm, *Moniezia expansa*, on Lambs. M. F. HANSEN, Kansas State College; A. C. TODD, Kentucky Agricultural Experiment Station; AND G. W. KELLEY, University of Nebraska.

116. The Embryonic Hooks of Some Anoplocephalid Cestodes of Mammals. K. C. KATES AND ALLEN MCINTOSH, Bureau of Animal Industry.

117. The Pathologic Changes Associated with *Thysanosoma actinioides*. REX W. ALLEN AND PATRICIA M. KYLES, U. S. Bureau of Animal Industry.

118. The Effects of a Protein-Deficient Diet on Resistance of Mice to *Hymenolepis* Infection. JOHN E. LARSH, JR., University of North Carolina.

119. Length of the Pupal Period of *Cuterebra buccata* (F.). F. D. ENZIE AND ALLEN MCINTOSH, Bureau of Animal Industry.

120. *Thélohania cambari* n. sp., a Microsporidian Parasite of North American Crayfish. VICTOR SPRAGUE, Lake Chatuge Biological Laboratory.

AUTHOR INDEX

Showing program number, which is also abstract number of each paper.

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ABSTRACTS

1. *The Epidemiology of Schistosome Dermatitis ("Koganbyo") in Japan.* G. W. Hunter, III, L. S. Ritchie, 406th Medical General Laboratory, Tokyo, Japan, and H. Tanabe, Okayama Medical School, Okayama, Honshu, Japan.

A "paddy itch" in the valley adjacent to Lake Shinji, Shimane Prefecture, Japan was discovered to be a schistosome dermatitis area, the first reported in Japan. The disease is known locally as "koganbyo," or "lakeside disease," and is of public health concern. The etiologic agent is the cercaria (*Cercariae sturniae* Tanabe, MS) of a bird schistosome, *Gigantobilharzia sturniae* n. sp. by Tanabe. The intermediate snail host is *Polypylis hemisphaerula* Benson, and the definitive hosts include the large starling, *Spodiopsar cineracous* (Temminck), the sparrow, *Passer montanus saturatus* Stejneger; and the wagtail, *Motacilla* (*Motacilla*) *grandis* Sharpe. The snail intermediate host occurs in irrigation ditches, paddies and commonly in seepage water between ridges prepared for winter crops. The environment of the snails in the paddies is drastically changed in the preparation of the soil for raising rice; many snails are buried in the mud, but escape later during cultivation. "Koganbyo" is moderate until the middle of July by which time the preparation of the paddies, the transplanting and cultivation have been completed. During the time of the first weeding from mid-July to mid-August the disease reaches the peak of severity. The incidence of infection in the snail was 5.5 percent in June 1949 and 5.0 percent in June 1950; however in July 1949 the incidence was only 1.4 percent. Intermediate and definitive hosts are widespread in Japan. Infected birds and snails have been found in areas other than Shimane Prefecture.

2. *Skin Testing for Schistosomiasis Japonica with Antigens from Adult Worms and Cercariae of* S. japonicum. G. W. Hunter, III, L. S. Ritchie, C. Pan, S. S. Lin, 406th Medical General Laboratory, Tokyo, Japan, M. Yokogawa, National Institute of Health, Tokyo, Japan, and S. Sugiura.

A series of 103 school children (11–15 years of age known to be positive by stool for *Schistosoma japonicum*) together with 68 controls (negative by stool) were skin-tested intradermally with 0.01 ml. of a 1:10,000 dilution of antigens made from adult worms and from cercariae of *S. japonicum*. The antigens were prepared as aseptically as possible, frozen and thawed, lyophilized and stored at –50°C. until ready for use at which time they were tested for sterility. Ninety-three percent of the positive cases were detected by both antigens. An increase of 3 mm. in the diameter of the wheal within 10–15 minutes as compared with the control was interpreted as a positive test. Previously, preliminary tests had been run using dilutions ranging from 1:1000 to 1:20,000; the results indicated that 1:10,000 was best. Originally, antigens were extracted by saline or alcohol. The latter did not yield as satisfactory results. Merthiolate in a dilution of 1:7500 was added as a preservative.

The merthiolated saline control gave no false positives in the 68 controls who were proven to be negative for schistosomiasis japonica. Extracts of the snail livers were used as an additional control for the cercarial antigen. Two of these gave false positives. Consequently, it is concluded that the antigen from the adult worm is more satisfactory for general use.

3. *Development of* Schistosoma mansoni *in the Peritoneal Cavity of Mice.* Donald V. Moore, and Henry E. Meleney, New York University, College of Medicine, New York.

Following the intraperitoneal injection of cercariae, observations were made on the rate of development of worms in the peritoneal cavity of mice and compared with the development of the worms which were able to escape from the peritoneal cavity and complete their development in the mesenteric-portal circulation of the host. Daily observations were made during the first 10 days of infection, and then at two-week intervals from two through twelve weeks. During the first ten days of infection, 89–100% of the worms recovered were found in the peritoneal cavity. From two weeks through twelve weeks of infection, 32–86% of the worms were found in the peritoneal cavity. The rate of development of the worms in the peritoneal cavity is equivalent to the development of the worms from the mesenteric portal system through four weeks after infection. Sexually mature worms are found in the portal system six weeks after infection. Worms in the peritoneal cavity do not reach sexual maturity until ten to twelve weeks after infection. The sexually mature worms from the peritoneal cavity are considerably smaller than the worms from the circulation. At twelve weeks after infection, examination of the worms from the peritoneal cavity revealed sperm in the seminal vesicle of the males, mature and functioning ovary and vitellaria in the female and mature egg in the ootype of some of the females. As controls, hamsters infected intraperitoneally were examined for the continued presence of worms in the peritoneal cavity. No worms were found in the peritoneal cavity of hamsters after two weeks of infection.

4. *Progressive Blood Changes in Experimental Infections with* Schistosoma mansoni *in Mice.* Eloise B. Cram, National Institutes of Health, Public Health Service, Bethesda, Maryland.

The study was initiated primarily to compare the eosinophilic response of mice to infections with *Schistosoma mansoni* of Egyptian and of American (Puerto Rican) origin; the comparison is significant in view of reported differences in pathological and clinical effects in man and biological differences in intermediate host relationships. Approximately 50, 100, 125, and 150 cercariae were used for cutaneous exposure. Total direct eosinophile counts and total and differential white cell counts were made previous to infection and approximately 1, 2, 3 and 4 months after infection. Data were obtained also from red cell counts, coagulation time and hemoglobin determinations. Worm counts and observations on comparative pathology concluded each experiment.

There were no *consistent* differences in blood picture associated with the two "strains." Eosinophilia was highly erratic; however, the average count increased faster in the American infections, was later surpassed by that of the Egyptian infections. Total white cell counts increased in both, perhaps more markedly in Egyptian infections in later stages, due to increase in lymphocytes and eosinophiles. There was a drop in hemoglobin, an increase in coagulation time, in both but especially with the American strain; the red cell count was fairly stable. Higher mortality and more severe tissue damage occurred with American infections.

5. *Eosinophil Response of Mice to Single Sex and Mixed* Schistosoma japonicum *Infections.* William B. De Witt, National Institutes of Health, Public Health Service, Bethesda, Maryland.

The effects on the number of circulating eosinophils resulting from infections with the Chinese strain of *Schistosoma japonicum* were studied. Forty mice were divided into 4 groups of 10 each. The mice in 3 groups were exposed to an average of 50 female cercariae each, 25 female and 25 male cercariae each, and 50 male cercariae each, respectively. The fourth group served as control. Direct eosinophil counts were made on the tail blood and the animals were weighed 5, 12, 20, 35, 49, and 63 days after exposure. Hemoglobin determinations were made on all of the mice on the 54th day.

The intestines, liver, and mesenteries were examined under a dissecting microscope for worms and eggs and the number of males, females, and immature worms were recorded.

Study of the data indicates that with *S. japonicum* only moderate increases in the number of circulating eosinophils result from unisexual infections, whereas in the mixed infection a marked eosinophilic increase appears toward the end of the incubation period. This marked increase seems to be associated with the maturing of the mated worms and their production of ova.

6. *Some Characteristics of Early Schistosome Infections in Mice.* Louis Oliver, National Institutes of Health, Public Health Service, Bethesda, Maryland.

Schistosoma japonicum, Schistosoma mansoni, and *Schistosomatium douthitti* infections in laboratory mice were compared during the first three weeks after exposure. Conditions of exposure and examination techniques were made as nearly uniform as possible. All mice were exposed by the cutaneous route to 100 cercariae each, except that in one *S. mansoni* series 200 cercariae were used. The lungs of all mice were examined for evidence of gross pathology and then teased and searched for worms. In addition, most of the lungs were perfused before they were teased. All livers were perfused and the perfusate searched for worms.

Observations on *S. japonicum* and *S. mansoni* were in accord with those previously recorded. *S. japonicum* produced many distinct pulmonary hemorrhages and reached the liver relatively early. Very few worms were recovered from the lungs and a large proportion of the cercariae applied to the skin were recovered from the liver as developing worms. *S. mansoni* produced relatively few, indistinct lung hemorrhages, were readily recovered from the lungs for an extended time, and reached the liver much later than *S. japonicum.* Only a relatively small proportion of the cercariae used were later recovered from the liver as developing worms.

S. douthitti infection was found to compare closely with that of *S. japonicum.* This species produced many distinct lung hemorrhages and reached the liver early. Relatively few worms were recovered from the lungs and a large proportion of the original number was recovered from the liver. It is noteworthy that young *S. douthitti* ingest, and apparently digest blood during lung passage, since almost all of the worms recovered from the lungs had enlarged guts with black or brown contents. The other two species probably do not digest blood during lung passage.

S. japonicum and *S. douthitti* are more successful than *S. mansoni* in the mouse. The relatively poor success of *S. mansoni* infections may be due to physiological incompatability between the parasite and the mouse. This assumption is plausible since *S. mansoni* is not a natural parasite of rodents while the other two species commonly infect small rodents.

7. *Development of the Mother and Daughter Sporocysts of a Snake Plagiorchiid,* Lechriorchis primus. W. W. Cort, The Johns Hopkins University; D. J. Ameel, Kansas State College; Anne Van der Woude, University of Michigan.

Studies were made on living material supplemented by sections, of the development of the sporocyst stages of *Lechriorchis primus.* After hatching in the digestive tract of the snail, the miracidia penetrate the intestinal wall and form small sac-like mother sporocysts containing small numbers of germinal cells. The mother sporocysts which are attached to the outside of the intestinal wall grow into larger sacs containing greatly increased numbers of germinal cells. Soon they send out branches, chiefly into the digestive gland, and form extensively branched sacs. Next, ingrowths of the wall divide the mother sporocyst into compartments each containing groups of germinal cells. As the germinal cells start to grow into embryos, each becomes surrounded by cells of the mother sporocyst wall, which form a permanent outer layer, the paletot, around the developing daughters. A few migrating stages of daughter sporocysts like those described for *Plagiorchis muris* have been found in some infections, but usually the daughters go through the characteristic growth stages and complete their development in masses in the digestive gland of the snail without migrating from the mother. In early daughter sporocyst embryos the germinal cells undergo a very limited number of divisions before the germinal mass is formed. These produce a few precocious cercarial embryos which are quite well developed before new embryos begin to be produced by the germinal mass. A few almost fully developed cercariae from these early divisions of the germinal cells were present as early as 17 days after experimental infection.

8. *Germinal Development in the Early Stages of the Mother Sporocyst and Rediae of* Paragonimus kellicotti. D. J. Ameel, Kansas State College; W. W. Cort, The Johns Hopkins University; Anne Van der Woude, University of Michigan.

Studies were made on living material, supplemented by sections, of the development of the germinal cells in the germinal sacs of *Paragonimus kellicotti.* In the youngest mother sporocysts there is some multiplication of germinal cells, and soon the most anterior of them begin to develop into embryos. At later stages, besides the redial embryos which fill the body cavity, a few germinal cells and small embryos are found attached at its posterior tip. Between 20 and 30 mother rediae are produced by each mother sporocyst.

In the mother redial embryos at about the time that the cells of the digestive system become well defined there is a morula-like group of germinal cells in the primitive body cavity. Soon the most anterior of these germinal cells develop into embryos and the majority of them have become embryos by the time the young mother rediae escape. A few germinal cells persist in older mother rediae which appear to be soon exhausted. Each mother redia produces about 30 daughters.

In the early stages of the daughter redial embryos the development of the germinal material is like that in the mothers. However, in later stages, instead of the germinal cells having only a limited period of multiplication, they are found in rather large persistent germinal masses which are still present in mature and old daughter rediae. This very great extension of the period of multiplication of the germinal cells provides for the production of large numbers of cercariae.

9. *Germ Cell Cycle of* Megalodiscus temperatus (Stafford, 1905) Harwood, 1932. Anne Van der Woude, University of Michigan.

The development of the miracidium, three generations of rediae, and the cercaria was followed from a single germinal cell to fully developed individuals. The germinal cells in each stage were found to be in direct lineal descent from the fertilized ovum. The germ cells of the adult undergo maturation and fertilization in a manner similar to that found in other trematodes.

A single germinal cell, lying in the posterior part of the developing miracidium, divides into an ectodermal cell and a propagatory cell. The cells resulting from the division of the ectodermal cell form the body of the single first generation redia which contains the descendants (germinal cells) of the propagatory cell. Each of these germinal cells gives rise to a second generation redia, and the germinal cells in the body cavity of the latter give rise to third generation rediae. The germinal cells in the third generation rediae form cercariae by a process of embryonic development similar to that found in the preceeding generations. The propagatory cell in the cercarial embryo divides repeatedly to form the genital primordium of the adult.

The germinal cells are distinguishable from the somatic cells by their slightly larger size, their clear nuclei which contain one or two large densely staining nucleoli and clumps of chromatin along the nuclear membrane.

No structures which could be interpreted as ovaries or testes were found in any of the redial generations. In all generations, the diploid number of chromosomes, counted in the

dividing somatic and germinal cells, was eighteen. Polar body formation and the haploid number were observed only in the maturation of the germ cells in the ovaries and testes of the mature cercaria and adult.

10. *Germ Cell Cycle of* Echinostoma revolutum (Froelich, 1802). Helen M. Churchill, Hollins College, Virginia.

The processes of spermatogenesis and oögenesis in the hermaphroditic adult resemble those of most other digenetic trematodes. Each primary spermatogonium gives rise to a cluster of 32 spermatids, as the result of three spermatogonial, and two maturation, divisions. Spermatid nuclei metamorphose into spermatozoa, the cytoplasm remaining as a residual mass. Oögonia and oöcytes do not cohere in groups. Penetration of the oöcyte by the spermatozoön apparently occurs only in the receptaculum seminis uterinum. The oöcyte undergoes its two maturation divisions after penetration of the sperm cell. Male and female pronuclei are complete when the egg has traveled about half the length of the uterus; further development does not occur until the egg is outside the host. The diploid number of chromosomes is twenty-two.

The first cleavage division in each generation (miracidium-sporocyst, first and second generation rediae, and cercaria-adult) is unequal, and the second cleavage affects only the larger cell. This similarity to species in which germinal lineage has been demonstrated in all generations suggests the presence of germinal lineage in *E. revolutum,* but it could not be followed.

The earliest recognizable germ cells in the rediae appear as the body cavity is forming. In older rediae, additional germ cells develop in the redial wall. The germ mass in the redia contains somatic nuclei, germ cells and young embryos. Multiplication of germ cells in the germ mass was not seen. Germ cells in the sporocyst and rediae do not undergo any maturation or fertilization processes.

11. *The Life History of* Neoleucochloridium problematicum (Magath, 1920) new comb. (Trematoda: Brachylaemidae). Irving G. Kagan, The University of Chicago.

Metacercariae encysted within red-brown sporocysts, described by Magath (1920) as *Leucochloridium problematicum,* develop into *L. sorae* McIntosh, 1927. The latter falls as a synonym of the former. The snail hosts in Michigan for this species are *Oxyloma retusa (Succinea retusa)* and an undesignated species of *Quickella.* Within the snail host tailless cercariae develop in branched sporocysts and encyst as metacercariae in highly colored red-brown broodsacs, which at times push out into the eye tentacles of the snail and pulsate actively. Snails with the contained broodsac and encysted metacercariae are eaten by birds of the family Rallidae (Florida Gallinules, Coots and Rails). Feeding experiments were conducted with 56 birds representing 16 species. The chick served as an experimental host. Negative results in 18 experiments with seven species of passerine birds suggests that host specificity may exist for this species. Excysted metacercariae attach to the wall of the cloaca and become sexually mature adults in five days. Eggs are recovered in the feces on the eighth day. Specimens developing in the Coot are larger and attain sexual maturity at a faster rate than corresponding specimens of the same age developing in the Gallinule, Rail and chick. Distome eggs passed in the feces of the host contain viable miracidia. Hatching of the miracidium normally occurs when the egg is eaten by the intermediate host. Miracidia were hatched in tap water after incubation in saline under refrigeration. The miracidium possesses five ciliated plates, a stylet and short stubby tail. Flame cells were not observed. Small sporocysts with colorless broodsacs were recovered from two laboratory reared *O. retusa* 37 and 58 days after exposure to eggs. The period of development for the broodsac is believed to be approximately three months.

12. *Contributions to the Life History and Morphology of* Gynaecotylae adunca (Linton, 1905). Wanda S. Hunter, Duke University.

Feeding experiments carried out at the Duke Marine Laboratory, Beaufort, N. C., confirmed the identification of *Gynaecotylea adunca* (Linton 1905) found as metacercariae in the fiddler crab, *Uca pugillator.* Adult worms with eggs in utero developed in young black skimmers *(Rynchops nigra nigra),* common terns *(Sterna hirundo)* and least terns, *(S. albifrons).* These experimental hosts carried the infection but a short time, indicating that they normally do not act as the definite hosts in nature. Infection data from naturally infected birds in the Beaufort region has been compiled. At least five different species of birds and three species of fish yielded adult *Gynaecotylea* which as yet cannot be separated morphologically from *G. adunca.* A redescription of the adult parasite and a complete description of the metacercariae are given.

13. *New Species of Rhopalocercous Cercariae.* Jacob H. Fischthal, Harpur College, State University of New York, Endicott, New York.

Five new species of rhopalocercariae in the trematode subfamily Gorgoderinae (Gorgoderidae) from freshwater clams in Michigan and New York are *Cercaria micromyae* from *Micromya iris* and *Alasmidonta marginata, C. catatonki* from *Strophitus undulatus quadriplicatus, C. honeyi* from *Anodontoides ferussacianus* and *Alasmidonta calceolus, C. pyriformis* from *Micromya iris,* and *C. filicauda* from *Elliptio dilatatus.*

All develop in simple, egg-shaped daughter sporocysts lying in the visceral masses of these unionid clam hosts. Within the sporocysts cercariae possess club-shaped tails, each with a much-plaited cuticula lined with large, loosely-arranged cells. Upon emergence into the water the latter is rapidly imbibed by the cuticula which swells into a balloon-like structure into which the cercarial body is quickly retracted. Encystment occurs within these transformed tails, resulting in the metacercarial stage.

The cercaria and metacercaria are nearly morphologically alike, differing only in that the latter has one pair of penetration glands less, and also lacks cystogenous glands. Cercariae lack a stylet; have sensory papillae over their bodies; have well-developed penetration glands; have definite circular cystogenous glands; have their reproductive systems differentiated into all their component parts; and have nervous systems of three main pairs of nerve cords. The excretory bladder is thick-walled, its development being similar to that described for stylet-bearing cercariae.

It appears probable that the related rhopalocercariae, macrocercariae and microcercaria have evolved from a common unknown ancestor. A divergence led to the present day rhopalocercariae on one hand, and another group, on the other. A further divergence occured in the latter group, resulting in the present day microcercaria and the large group of macrocercariae.

14. *Resistance of Fowls to Parasitism Affected by Female Sex Hormone.* J. E. Ackert and L. W. Dewhirst, Kansas State College, Manhattan.

Growing chickens have been found to reach their maximum resistance to the nematode *Ascaridia galli* at about the age of sexual maturity.

Three experiments were conducted on 140 pullets to determine if injections of the female hormone, diethylstilbestrol, will increase the resistance of chickens to *A. galli.* Divided into (1) experimental groups and (2) control groups, the fowls were parasitized with 200 ± 10 *A. galli* eggs and the experimentals given tri-weekly injections of the hormone for three weeks, after which the fowls were autopsied and the *A. galli* collected.

The hormone injections produced a secondary sexual behavior pattern and a greatly enlarged oviduct in each fowl; whereas the controls exhibited normal behavior for their age and had no enlarged oviducts.

The worm counts showed an average of 11.3 worms per experimental fowl and 15.5 *A. galli* per control chicken. Statistical analysis of the data on numbers of worms indicates that the injections of this sex hormone increased the resistance of young female chickens to the nematode *A. galli.*

15. *Further Studies on the Tissue Phase of the Life Cycle of* Ascaridia galli. R. L. Tugwell, University of Tennessee and J. E. Ackert, Kansas State College, Manhattan.

The tissue phase of the life cycle of *Ascaridia galli* is considered to be the phase in which the young worms bury their anterior ends in the mucosa of the small intestine.

Studies on 134 young chickens parasitized with 200 to 500 *A. galli* eggs have shown that (1) the tissue phase may begin on the first day of parasitism by a few *Ascaridia* and continue at least to the 26th day, but (2) that the great majority of the young *A. galli* make their sojourn in the intestinal mucosa from about the 8th to the 17th day of parasitism; that (3) growth rates of tissue and lumen larvae are about equal until the 17th day of parasitism, after which the lumen worms make normal growth but the tissue larvae little growth; and that (4) failure of the tissue phase larvae to make growth comparable with that of the lumen larvae explains the occasional presence of diminutive larvae in lumen flushings.

16. *Relationships of Aging, Food Reserves, and Infectivity of Some Ascarid Larvae.* D. J. Ameel, Kansas State College, Manhattan; Alice Elliott, Kansas State Teachers College, Pittsburg; J. E. Ackert, Kansas State College, Manhattan.

A physiological study was made of the effects of age on the infectivity of eggs of the fowl nematode, *Ascaridia galli* and of dog and cat ascarids.

The results from four experiments showed that the average number of *A. galli* per chick was markedly larger from the infections from the younger egg cultures than from the older cultures.

Rather high infectivity of *A. galli* eggs existed until the cultures were 200 days old, after which a rapid decline in infectivity occured.

Hatching of eggs of *A. galli, T. mystax, T. leonina* was induced by an adaptation of Pitts' method for *Ascaris* eggs. Measurements of the fat-containing areas in the bodies of the different aged larvae which were stained with Schlarch R demonstrated a diminution of fat (food reserve) with increase of age of larvae.

Fat content was lost more rapidly in the younger than in the older larvae; however, the initial fall in fat content was greater than the fall in infectivity. The rate of fat diminution in larvae was hastened in maintaining egg cultures at higher temperatures, but retarded in maintaining the cultures at lower temperatures.

Maintenance of embryonated egg cultures of the fowl nematode, *A. galli,* at optimum temperatures for periods of more than 200 days results in the loss of a large portion of the fat reserves and of most of the infectivity of the larvae.

17. *Parasitological Studies in the Far East. V. An Epidemiologic Survey in Okayama Prefecture, Honshu, Japan.* L. S. Ritchie, G. W. Hunter, III, E. H. Kaufman, C. Pan, 406th Medical General Laboratory, Tokyo, Japan, K. Nagano, Kitasato Institute, and M. Yokogawa, National Institute of Health, Tokyo, Japan.

Okayama Prefecture is located on the Inland Sea in southwestern Honshu. A total of 1260 persons about equally distributed in three different localities (Okayama-City, and the villages of Notani and Kojo) were examined. Intestinal parasites occurred in 89.4 percent of the examinees; 85.6 percent had helminths and 38.2 percent protozoa. Specific helminths and their incidence were as follows: *Ascaris,* 51.3; whipworm, 29.8; hookworm, 45.4; *Trichostrongylus* sp., 1.7; *C. sinensis,* 16.5; *M. yokogawai,* 4.1; and pinworm (by scotch tape), 15.1 percent. A diversity of heterophyid ova of uncertain identity were encountered in this area. Protozoan rates were as follows: *E. histolytica,* 4.0; *E. coli,* 25.2; *E. nana,* 14.1; *I. butschlii,* 1.5; *G. lamblia,* 5.6; and *C. mesnili,* 3.2 percent.

The incidence of *Ascaris* and whipworm was generally low; highest in the urban population, and lowest (*Ascaris* in particular – 34.9 percent) in Kojo. The incidence of hookworm was 68.4 percent at Notani which was twice that found in the other two communities. *Clonorchis sinensis* occurred in 40.3 percent of those examined at Kojo. Protozoa were lowest at Kojo where the occurrence of *E. histolytica* was only 2.0 percent. This village is a part of an extensive "fill," reclaimed from a bay. Water in the canals is brackish and subterranean water is also unsuitable for drinking. The domestic water supply comes from three sources: (1) rainwater, (2) a single hydrant at the borderline of an adjacent village (source-mountain reservoir) and (3) water boats.

18. *Parasitological Studies in the Far East. X. An Epidemiologic Survey on Hokkaido, Japan.* L. S. Ritchie, G. W. Hunter, III, C. Pan, 406th Medical General Laboratory, Tokyo, Japan, and M. Yokogawa, National Institute of Health, Tokyo, Japan.

A parasitological survey of intestinal parasites was made of Hokkaido, the northernmost main island of Japan. The latitude and climatic conditions are essentially those of northeastern New England. A total of 2211 individuals in 19 widely distributed population centers, including one mining, four urban, four fishing and ten farming communities, were surveyed. One or more parasites were found in 86.4 percent of the people examined; 79.3 percent had helminths and 48.1 percent protozoa. Specific helminths and incidence were as follows: *Ascaris,* 68.1; whipworm, 29.4; hookworm 1.9; *Trichostrongylus* sp., 16.9; *S. stercoralis,* 0.2; pinworm (by scotch tape), 48.4; *C. sinensis,* 0.5; *H. nana,* 0.1; and *M. yokogawai,* 0.1 percent. Hookworm infections of low intensity occurred with an incidence of about 7.5 percent in two of the communities, one of which was near the northern tip of Hokkaido. Although hookworm does not constitute a public health problem in Hokkaido, its presence nevertheless clearly indicates the ability of hookworm to maintain itself in relatively cold climates. Protozoa occurred as follows: *E. histolytica,* 10.2; *E. coli,* 32.2; *E. nana,* 21.1; *I. butschlii,* 2.5; *G. lamblia,* 6.2; and *C. mesnili,* 0.9 percent. Protozoa infections were unusually common in a tribe of the aboriginal Ainu, where the incidence of *E. histolytica, E. coli* and *E. nana* were 26.2, 48.2 and 34.9 percent respectively.

19. *Parasitological Studies in the Far East. XI. An Epidemiologic Survey of Okinawa.* G. W. Hunter, III, L. S. Ritchie, C. Pan and S. Lin, 406th Medical General Laboratory, Tokyo, Japan.

In July and August 1949 a survey was made on Okinawa to secure data on the incidence of intestinal parasites, both helminths and protozoa, as well as malaria, filariasis and other

endemic diseases. A total of 2172 natives from the nine districts were examined for intestinal parasites. Of these 90.1 percent were parasitized, 88 percent having helminths and 40 percent protozoa. The incidence of each of the specific helminths follows: hookworm, 71.8; *Ascaris,* 48.1; whipworm, 20.1; *Trichostrongylus* sp., 1.8; pinworm (by scotch tape), 18.7; *Strongyloides stercoralis,* 11.9; *C. sinensis,* 0.6 percent. Other helminths encountered infrequently included: *Schistosoma mansoni* and *S. japonicum* (from two individuals who gave histories of having been in endemic areas elsewhere), *Hymenolepis diminuta, H. nana, P. westermani,* and *Heterophyes* sp. The incidence of protozoa was: *E. histolytica,* 13.4; *E. coli,* 19.8; *E. nana,* 21.1; *I. butschlii,* 1.8; *G. lamblia,* 6.2; and *C. mesnili,* 0.9 percent.

Of the 1,406 blood smears examined for malaria, 4.8 percent were found to be positive. The highest incidence of malaria occurred at Henoko where 15.9 percent were positive. These were all identified as *P. vivax.* A total of 1,262 blood specimens were examined for filariasis, 9.6 percent of which were positive for *W. bancrofti,* with a peak of 28.1 percent at Kadena.

A total of 340 American occupation personnel were also examined on Okinawa. Of these 4.4 percent were infected with helminths and 31.6 percent with protozoa. This group was divided into those who had been there less than three months and those who had been there longer. There were no helminth infections found in the former group and a relatively low incidence of protozoa. In the latter group the parasites were as follows: *Ascaris,* 0.6; whipworm, 1.9; hookworm, 25; *Strongyloides,* 0.6; *E. histolytica,* 5.1; *E. coli,* 15.3; *E. nana,* 15.9; *I. butschlii,* 1.9 and *G. lamblia,* 5.1 percent. On the basis of this small sample it appears that there is an increase of approximately 12 percent in the parasitic infections of those Americans who have been on Okinawa three months or longer.

20. *The Distribution of the Snail Intermediate Host of Schistosoma japonicum (Oncomelania nosophora) Along the Tone River, Japan.* L. S. Ritchie, G. W. Hunter, III, C. Pan, 406th Medical General Laboratory, Tokyo, Japan, and K. Nagano, Kitasato Institute, Tokyo, Japan.

The actual status of schistosomiasis and the distribution of the snail, *O. nosophora,* along the Tone river in east-central Honshu are not well known. Work by Japanese investigators was limited largely to the period 1914–15. Wright et al (1947, Am. J. Trop. Med. 27: 417–448) on the basis of a limited survey felt that the entire valley from Sakai to Sawara should be considered as a possible endemic area; however, they failed to recover snails there. Oliver (1948 Am. J. Trop. Med. 28: 867–875) located an infected colony near Koya village. It has been recognized and currently confirmed that the snails are limited almost entirely to the area between the levees, and the main channel. Construction of dikes appears to have resulted in the disappearance of snails from areas reclaimed as farm lands. The fifty mile sector of the river bed from Sakai to Sawara was searched on both sides of the channel for snails during the fall of 1948 and spring of 1950. From Sakai, upriver, and the junction of the Kinu river with the Tone, snails were found only infrequently. From the above river junction to Sawara, 35 miles down river, snails were found at many points on both sides. A 3–4 mile sector in the Fusa-Fukawa area was unsuitable for snails. They seemed to be more numerous on the side bordering Ibaraki Prefecture than on the Chiba side.

Snails were collected at about 35 different places on the two sides of the river, and at seven of these 100 or more snails were found. Four were in the region of the upper limits and two near the lower limits of the area surveyed. All of these could certainly be considered centers of reproduction (young snails were found in the collections) and probably permanent colonies, as two of them have been shown to be present over a period of several years, during which time severe floods have occurred. It would appear that snails occur almost uninterruptedly on the northern side (Ibaraki-Prefecture) throughout the 10-mile sector between the points where the Kinu and Kogai rivers enter the Tone. Infected snails were found in only four of the collections made, three of which were well upriver and one midway in the area surveyed, but the presence of uninfected snails constitutes a potential threat to persons living in that area.

21. *Parasites of the goldeye,* Amphiodon alosoides, *in Lake Texoma.* J. Teague Self, University of Oklahoma.

Fish parasite collections from Lake Texoma reveal that the goldeye, *Amphiodon alosoides,* is heavily parasitized by two species of papillose flukes belonging to the genus *Crepidostomum* as well as cestodes of the genus *Bothriocephalus.*

22. *Life History Contributions to the Subfamily Ochetosomatinae Leão, 1944 (Reniferinae Pratt, 1902).* John D. Goodman, Univ. of Michigan.

The members of the subfamily *Ochetosomatinae* Leão, 1944, parasitic in the digestive and respiratory tracts of new world snakes, have had little attention since the work of McCoy (1928), Talbot (1933), and Byrd (1935). Recently I have studied the genera *Ochetosoma, Stomatrema*

Neorenifer, Lechriorchis, Dasymetra, Pneumatophilus, Zeugorchis, and *Natriodera.* Miracidia of species of these genera readily infect snails of the genus *Physa,* with the exception of the genus *Natriodera.* Attempts to infect *Physa* with the eggs of *Natriodera* were unsuccessful. A careful study of the anatomy, particularly the excretory system, indicates that the genus *Natriodera* does not belong in the subfamily *Ochetosomatinae,* but in a separate subfamily with *Macrodera* Looss, 1899, in the family Plagiorchiidae Lühe, 1901.

The remaining genera all have similar life history stages. Sporocysts in the snail liver produce Xiphidiocercariae of the Armatae type with bladder arms encircling the acetabulum, and with main collecting vessels entering far down on the arms. Experiments show that cercariae in this subfamily will encyst in tadpoles and produce metacercariae which are infective for snakes in about three weeks. Laboratory reared toad tadpoles reacted variously to the cercariae of these genera. Cercariae of *Dasymetra* and *Pneumatophilus* produced death within a few hours to several days, depending upon intensity of infection. Tadpoles exposed to *Dasymetra* cercariae were riddled in a few hours. One, killed in four hours had 199 metacercariae of *Dasymetra* encysted in various parts of the body. Cercariae of *Neorenifer* and *Stomatrema* produce much less severe infections. Tadpoles remained alive and active indefinitely when kept with snails liberating these cercariae. Examinations after two weeks' time found 44 metacercariae of *Neorenifer* encysted beneath the skin of the belly, legs, and tail. Metacercariae of *Stomatrema* were always found encysted in either the mouth or cloaca, seldom more than two or three metacercariae being found in a single infected tadpole.

23. Gigantobilharzia huronensis sp. nov., *a Bird Blood-fluke from the Goldfinch.* Abbas T. Najim, University of Michigan.

The cercaria was found in *Physa* cf. *gyrina* (Say) collected from the Huron River at Delhi near Ann Arbor, Michigan.

It has been possible to infect, experimentally, canaries and chicks. The adults prove to be related to the genus *Gigantobilharzia.* In nature, the goldfinch, *Spinus tristis tristis,* has been found to be infected.

Insofar as has been determined, this species has not been recorded previously and the only record of the genus in the United States is the work of Brackett (1942).

The male measures about 9.6 mm. in length and .063 mm. in width. A gynaecophoric canal is present. Suckers are absent. Testes are numerous, 300±, rounded to oval and close together. A large spinous cirrus is present.

The female measures about 21.3 mm. in length, ranging from 18 to 29 mm., and .049 mm. in width in the esophageal region. Laurer's canal is present. Suckers are absent.

The eggs hatch in water and the earliest cercariae are liberated from the snail in 24 days. Longer time is required at winter temperatures. After the first exposure to the cercariae, eggs are found in the feces of the definitive host in 31 to 38 days.

24. *Revision of the Subfamily Leucochloridiinae (Trematoda: Brachylaemidae).* Irving G. Kagan, The University of Chicago.

Comparative morphological studies of distomes from experimental feeding experiments and those collected from birds in southeastern Michigan and comparisons of these with species described in the literature revealed the necessity for a systematic revision of the subfamily Leucochloridiinae. The genus *Leucochloridium* Carus, 1835 was found to be a complex of three genera requiring that it be subdivided into the genera *Urogonimus* Monticelli, 1888, *Leucochloridium* Carus, 1835 and *Neoleucochloridium* gen. nov. These genera and the genus *Urotocus* Looss, 1899 are recognized in the subfamily *Leucochloridiinae* Poche, 1907. On the basis of morphology and life history studies the genera *Panopistus* Sinitsin, 1931 and *Urorygma* Braun, 1901 have been excluded from the subfamily. The genus *Urogonimus* Monticelli, 1888 is validated and removed from synonymy with *Leucochloridium* Carus, 1835. Ten species are recognized in the genus *Leucochloridium,* 14 species in *Urogonimus,* five species in *Neoleucochloridium* and two species in *Urotocus.*

The following species formerly placed in synonymy with *Urogonimus macrostomus* (Rudolphi, 1803) have been found to be different and distinct and have been renamed: *U. witenbergiella* sp. nov. (*L. macrostomum* of Witenberg 1925), *L. paradoxum* Carus, 1835 (*D. macrostomum* of Zeller, 1874), *L. heckerti* sp. nov. (*D. macrostomum* of Heckert, 1899), *U. caryocatactis* (Zeder, 1800) (*D. caudale* Rudolphi, 1809, *D. caudale* of Mueller, 1898).

The following species have been reduced to synonymy: *L. insigne* of Witenberg (1925) with *L. heckerti* sp. nov., *L. sp.* of Hsü (1936) from *Pavoncella pugnax* with *L. paradoxum* Carus, 1835, *L. sp.* of Hsü (1936) from *Vanellus vanellus* with *L. heckerti* sp. nov., *L. actitis* McIntosh (1932) with *L. cyanocittae* McIntosh (1932) and *L. pricei* McIntosh (1932) with *L. variae* McIntosh (1932).

25. *Erratic Hirudiniasis in a Lake Trout* (Cristivomer namaycush). MARVIN C. MEYER, University of Maine AND RALPH V. BANGHAM, The College of Wooster.

Hirudiniasis, commoner and involving more species of leeches and hosts than most textbooks in parasitology imply, might be considered under three general types: strictly external and in most cases only temporary; migration inward to such locations as the eyes, the upper respiratory passages and the anterior portion of the alimentary canal, and of a more permanent relationship, occasionally remaining attached for a month or longer; and erratic, involving a chicken's egg, the sub-cutaneous lymph spaces of a frog, the anus and the urogenital passages of both sexes of man. Since the current case of erratic hirudiniasis involves an organ previously unreported, it warrants recording.

A specimen of *Nephelopsis obscura* Verrill, 1872, measuring 60×8 mm., was dissected out of the air bladder of a lake trout (*Cristivomer namaycush*), a physostomid fish taken at Jackson Lake, Wyoming, by one of us (R. V. B.). The question which is natural to ask is, how did this erpobdellid leech, a predator feeding on aquatic oligochaetes and insect larvae, reach this unique position? Since the air bladder showed no breaks, entrance through the pneumatic duct is suggested as the likely portal of entry. In view of the remarkable ability of leeches to distend and contract, this route appears entirely possible, despite the relatively small diameter of the pneumatic duct. This explanation is strengthened by a somewhat similar case, one of several such cases known, recorded by Mitra (1926. Indian Med. Gaz. 61: 22). He reported a case of a leech, measuring 102×13 mm., passing through the urethra and entering the urinary bladder of an eight year old child, from which it was expelled.

26. *A New Secondary Intermediate Host for* Postharmostomum helicis (*Trematoda: Brachylaemidae*). MARTIN J. ULMER, Iowa State College.

The land snail, *Stenotrema monodon,* collected in the vicinity of Ann Arbor, Michigan, harbors within its pericardial cavity mature *Postharmostomum helicis* metacercariae. This brings to 12 the total number of land snails and slugs capable of serving as secondary intermediate hosts for this parasite. Sporocyst and cercarial stages are restricted to *Anguispira alternata.*

Attempts to experimentally infect the following molluscs with *P. helicis* cercariae were unsuccessful: *Gastrocopta armifera, Cionella lubrica, Rumina decollata,* and *Campeloma decisum.*

27. Brachylaima rauschi *n. sp. from an Arctic Lemming,* Dicrostonyx groenlandicus rubricatus (*Richardson, 1839*). ALLEN MCINTOSH, Zoological Division, Bureau of Animal Industry, U. S. D. A.

Several specimens of a small trematode belonging to the family Brachylaimidae were collected by Dr. Robert Rausch at Point Barrow in his survey of parasites of microtine rodents in Alaska. The parasites vary in length from 1.8 mm. (immature specimens) to 5.9 mm. Body aspinose, subcylindrical, tapering posteriorly; maximum breadth 570 μ. Oral sucker 350 μ by 330 μ with circular mouth opening; prepharynx 70 μ long; pharynx about 200 μ in diameter; intestinal crura extending almost to body tip; acetabulum 230 μ in diameter, its antherior margin 540 μ from posterior margin of oral sucker in type specimen. Ovary and testes in middle third of posterior half of body, approximately; testes subglobular, separated by ovary. Anterior testis approximately 270 μ in diameter; posterior testis 330 μ by 270 μ, its posterior margin in type specimen 1.15 mm. from posterior end of body. Vitellaria lateral to intestinal crura, extending anteriorly to, or almost to, zone of acetabulum and posteriorly to zone of anterior testis. Uterus in fully gravid specimens extending anteriorly to a point about midway between intestinal fork and acetabulum; genital pore near level of anterior margin of anterior testis. Eggs brownish-yellow, 32 μ by 18 μ. In the size-ratio of the suckers and in the relatively greater distance to which the reproductive organs are removed from the posterior end of the body the new species is distinguished from the other 30-odd species of the genus. Dujardin's (1843) original orthography for the generic name instead of Blanchard's (1847) emendation is used. This is in conformity with the recent ruling (Opinion 148) of the International Commission of Zoological Nomenclature.

28. *Substance Testing and the Physical Composition of* Endamoeba histolytica *Cultivation Medium.* E. CLIFFORD NELSON, Medical College of Virginia, Richmond, Virginia.

Egg-yolk extract incorporated in an agar slant base overlayed with buffered saline produces an effective medium for the growth of *E. histolytica.* The same concentration of extract suspended in buffered saline will not obtain growth. The difference in result appears to be due to the difference in physical state of the extract. In the saline suspension lipid globules, especially lecithin globules, are abundant. These are ingested by the amebae and apparently forestall starch ingestion essential to the growth of the organism. Soy or animal lecithin incorporated in agar

was found to serve as an effective medium. In buffered saline suspension, lecithin gave moderate growth at a concentration of 20 mg. per cent. Concentration above or below this level diminished growth to zero. It is suggested that it may be advantageous to test the tolerance of *E. histolytica* for a substance when it is held in close proximity in an agar base as well as in dilution in a liquid medium.

29. *The Effect of Dietary Ascorbic Acid Deficiency on the Susceptibility of Guinea-pigs to Infection with* Endamoeba histolytica. Elvio H. Sadun, Tulane University.

A total of 178 young guinea-pigs were used to study the effect of dietary ascorbic acid deficiency on the host-parasite relationship to *Endamoeba histolytica* of human origin. Of these, 65 received a purified diet deficient in ascorbic acid, 72 the same diet with an oral supplement of 20 mgms. each of ascorbic acid every other day and 41 a crude mildly scorbutogenic diet. Results at necropsy within 20 days from the time of intracecal inoculation of *E. histolytica* trophozoites indicated that 87 per cent of the guinea pigs on a purified scorbutogenic diet, 82 per cent of those on a crude mildly scorbutogenic diet and 67 per cent of those on a purified diet adequate in ascorbic acid were infected. The mortality of those that died as result of cecal ambeiasis in the three groups was respectively 87, 65 and 27 per cent. The mean time from inoculation to death was respectively 11.4, 14.4 and 15.4 days. The increased susceptibility of guinea-pigs on the scorbutogenic diets does not necessarily mean that Vitamin C *per se* is directly operating in the mechanism of resistance, since the deficiency in ascorbic acid caused a diminution of the total caloric intake as well as possible deficiencies of other dietary elements.

30. *The Effect of Dietary Carbohydrate on* Endamoeba histolytica *Infections in the Rat.* Joseph Greenberg and D. Jane Taylor, Public Health Service, Bethesda, Maryland.

The intensity of induced *Endamoeba histolytica* infections in laboratory rats was found to vary directly with the type of carbohydrate fed to the animals in a synthetic diet. The basic diet contained 70 per cent carbohydrate, 20 per cent casein, 5 per cent fat, 4.0 per cent salts, and essential vitamins. When the carbohydrate was sucrose, glucose, maltose or dextrin the mean average degree of infection (ADI) was between 1.5 and 2.0 out of a possible 5.0. With starch (corn or rice), levulose and cellulose as the carbohydrate, the mean average degree of infection was less than 1.0. When 25 per cent or more of the carbohydrate was lactose or 50 per cent or more galactose (the remainder being sucrose) the ADI increased in proportion to the amount of lactose or galactose in the diet.

Commercial rat pellets produced an ADI approximately the same as that found with the synthetic diet with sucrose as the carbohydrate. A compounded rat breeder diet and a special guinea pig diet both of which contained dry skim milk, produced an ADI approximately the same as that found with the synthetic diet with lactose as the carbohydrate.

31. *Chemotherapy of* Endamoeba histolytica *Infections in the Rabbit.* George W. Lutter-moser, W. T. Haskins, Nell Coleman, and John R. Jumper. National Institutes of Health, Public Health Service, Bethesda, Maryland.

Six hundred New Zealand Giant rabbits were inoculated intracecally with *Endamoeba histolytica* cultures of amoeba strain 200 associated with organism *t*, or with the intestinal flora of rabbits or of monkeys. Fifty percent of 34 rabbits inoculated with 200*t* became infected; 12 (70.5 percent) of these survived an average of 21.4 days. Eighty percent of 41 rabbits given 200R were infected; 31 (93.9 percent) of these survived an average of 16.6 days. Ninety-two percent of 91 animals inoculated with 200 NRS became infected; 78 (85.7 percent) of these survived an average of 14.6 days. Active trophozoites but no cysts were found in dysenteric ejecta.

Cultures 200R and 200 NRS were employed in a study of the chemotherapy of acute ulcerative amoebiasis. Chiniofon, diodoquin, or vioform in daily oral doses totaling 80,100, and 200 mg./kg. starting day 2 to 10 did not appreciably alter infection rate or survival time. Starting 2 days before inoculation and continued for 20 days, 30 mg. diodoquin/kg. did not prevent development of fatal infection; however, the treated rabbits survived on the average 5 days longer. Emetine, 1.0 mg./kg. given subcutaneously b.i.d. for 10 to 12 days, whether begun 2 days before or on various days after inoculation, had no effects. Doses of 200, 300, and 400 mg. aureomycin/kg., starting day 6 to 9 for 14 days, failed to prevent fatal infections. Animals receiving 25 or 50 mg. aureomycin or terramycin/kg., starting day 0, 1, or 2, survived at least 5 days longer than the controls and harbored few or no lesions.

32. *Transfaunation Studies on the Host-Specificity of the Enteric Protozoa of Rodents.* L. H. Saxe, University of Pennsylvania and the State University of Iowa.

Breeding colonies of protozoan-free laboratory rats (*Rattus norvegicus*) and golden hamsters

(*Mesocricetus auratus*) were established by early weaning and/or drug treatment and the progeny were fed material from various rodents in the following attempted transfaunations:— (+ = successful transfaunation; 0 = no successful transfaunation)

Cavia porcellus to rat: 0. *Citellus tridecemlineatus* to rat: 0. *Marmota monax* to rat: 0. *Dipodomys merriami* to rat: 0. *Mus musculus* to rat: *Giardia muris* +, *Hexamitus muris* +, *Octomitus intestinalis* +, *Trichomonas muris* +, *Chilomastix bettencourti* +, *Entamoeba muris* +. *Neotoma fuscipes* to rat: *Hexamastix muris* +, *other protozoans* 0. Hamster to rat: *Giardia lamblia* +, *G. muris* +, *Hexamitus muris* +, *Trichomonas muris* +, *T. minuta* +, *T. hominis* +, *T. microti* +, *T. wenyoni* +, *Hexamastix muris* +, *Chilomastix bettencourti* +, *Enteromonas* sp. +, *Monocercomonoides* sp. +, *Entamoeba muris* +, *Microtus pennsylvanicus* to rat: *Trichomonas microti* +, other protozoans 0.

Cavia porcellus to hamster: 0. *Citellus tridecemlineatus* to hamster: 0. Rat to hamster: *Giardia lambia* +, *Hexamitus muris* +, *Octomitus intestinalis* +, *Trichomonas muris* 0, *T. minuta* 0, *T. hominis* +, *T. microti* +, *T. wenyoni* +, *Hexamastix muris* 0, *Chilomastix* small sp. 0, *Entamoeba muris* +. *Mus musculus* to hamster: *Giardia muris* +, *Hexamitus muris* +, *Trichomonas muris* +, *T. minuta* +.

As far as laboratory rodents are concerned the protozoan fauna of *Cavia porcellus* is morphologically distinct and specific to that host. In general, the same protozoans occur in both the laboratory rat and hamster and certain of these species also occur in *Mus musculus*. Organisms found in certain wild rodents in most cases appear to be distinct, at least physiologically, from their counterparts in the protozoan fauna of laboratory rodents.

33. *A Survey of Blood Parasites in Domestic Animals in South Carolina.* Floyd O. Atchley, The Communicable Disease Center, Public Health Service, Federal Security Agency and the State Board of Health of South Carolina.

More than 1,600 domestic animals were surveyed for blood parasites in a certain area in Clarendon County, South Carolina. The study was undertaken in search of the identity of malaria-like infections in anopheline mosquitoes. These infected mosquitoes are still collected in the area where no blood-positive cases of human malaria have been observed since February 1949. Although *Plasmodium* was not found, various other blood parasites were observed in the domestic equine, bovine, canine and avian animals sampled. None were encountered in the porcine animals examined. Noteworthy among the findings was the occurrence of a *Leucocytozoon* in the domestic chicken (*Gallus gallus*). No previous report of this genus from the chicken in this hemisphere was located in the literature. Since this parasite was recorded in approximately fifteen percent of several hundred chickens tested, and the latter are quite numerous in the area, the infections in the mosquitoes may be associated with this organism which is closely related to malarial parasites.

34. *Natural and Artificial Infections with* Leucocytozoon simondi *Mathis and Léger in Ducks.* A. Murray Fallis, Douglas M. Davies and Marjorie Vickers, Ontario Research Foundation, Toronto, Canada.

Parasites have been observed in erythrocytes and lymphocytes in natural infections. Parasites were never found in the peripheral blood in less than five and one-half days after exposure to natural infection and more often they were not detected until six to seven days after exposure. Artificial infections have been produced by injections of emulsified black flies that had been fed three, four, five, six and seven days previously on infected ducks. Transmission was accomplished in this way using *Simulium venustum* and *Simulium jenningsi*. Infections were produced also in ducks by injecting them with spleen, liver, blood and bone marrow removed from ducks at the following intervals after their exposure to natural infection: spleen—three to six days, and eight to nine days; liver—six to seven days; blood—three and four and one-half days; bone marrow—three days. Infections resulted also from injections of brain and lung tissues from infected ducks. Parasites were not observed in the peripheral blood for at least eight, and in several instances ten to fourteen days after an artificial infection. Anemia was observed in the ducks infected naturally in some of which the blood cell volume was sometimes less than fifty percent of normal and the haemoglobin values were twenty percent of normal. There was a high mortality among the ducks infected naturally but none among those infected artificially. Ducks exposed to continuous infection developed some tolerance or resistance to the parasite, but no marked resistance to infection was apparent following a single artificial or natural infection. Blood containing parasites in round and elongate host cells was transfused into non-infected ducks. Similar parasites in round and elongate cells were found for at least six days in the peripheral blood of the ducks receiving the transfusion.

35. *The Relapse Phenomenon in* Leucocytozoon simondi *Infections in Domestic Ducks.* Eli Chernin, The Johns Hopkins University.

The maintenance of *L. simondi* infections in nature from season to season among ducks is dependent upon the reservoir of parasites made available to the arthropod intermediate host by chronically infected birds. It has been known for some years that ducks which survive initial infestation during the summer relapse the following spring after an intervening winter period of parasitic dormancy.

Naturally infected White Pekin and hybrid ducks were secured at the University of Michigan Biological Station during the summers of 1948 and 1949. Laboratory studies conducted during the winter-spring periods of 1948–49 and 1949–50 with these ducks have shown this spring relapse to be consistently associated with the onset of reproductive activities among ducks infected the previous summer. Parasites were found only sporadically and in very low number during the winter months prior to this rise in parasitaemia. Preliminary observations indicated that within a matter of days after the ducks commenced egg-laying, the level of parasitaemia began to rise and that parasites were to be found thereafter in the peripheral circulation for periods ranging up to six months.

As a result of photoperiodic manipulation it has been possible, within certain limits, to speed up or to delay the onset of sexual maturation and thereby to speed up or delay the occurrence of the parasitic relapse in ducks coming into their first breeding season. Birds exposed to 16 hours of artificial light per day during the winter went into egg-laying earlier and relapsed earlier parasitologically than did controls under standard animal room conditions of light or ducks which had been exposed to only five and one half hours of artificial light per day.

Studies designed to elucidate the relationship between the relapse of the haemosporidian infection and the physiological status of its avian host are still in progress and, in general, suggest that some hormonal mechanism probably underlies the phenomenon.

36. *The Mosquito Transmission of the 1P Strain of* Plasmodium relictum *to Pigeons.* W. B. Redmond, Department of Biology, Emory Univ., Ga.

Since all attempts to transmit the 1P strain of *P. relictum* from pigeon to pigeon by insects had failed, the direct transfer of the parasites from the parents to the young in the feeding process seemed a possibility. Attempts to obtain transfer of this parasite to the young from both active and latent infections in the parents during the feeding period have likewise failed.

Infection of one squab—exposed when 8 days old—was obtained from *Culex pipiens* which had previously fed on an infected canary. A very low grade infection remained active for 31 days and was terminated by the death of the bird. Blood transfer to another squab produced a high infection. Blood transfers to adult pigeons have produced only very light infections. Further attempts to transmit this strain by mosquitoes have failed.

37. *The Position of Protective and Sparing Factors in the Protein Component of the Plasma of Ducks Recovered from* Plasmodium lophurae *Infection.* Elery R. Becker and Thomas M. Schwink, Iowa State College.

Fractionation of the pooled plasmas of adult or near-adult immune ducks was accomplished at low temperatures by various concentrations of ammonium sulphate. Fraction A ("fibrinogen") was precipitated at 20 percent concentration; Fraction B ("euglobulin"), at 20–33 percent concentration; Fraction C ("pseudoglobulin I" plus "pseudoglobulin II") at 33–50 percent concentrations. Fraction D ("albumin") was the supernatant over Fraction C. In 4 tests of the fractions in young chicks infected with *P. lophurae,* made in accordance with the procedure previously outlined by us, notable amounts of protective antibody were located in Fraction A, but no sparing substance. Considerable amounts of both protective and sparing factors were found to occur in each of Fractions B and C. Fraction D had little or no influence on the course of the *P. lophurae* infection, and so may be presumed to contain neither protective nor sparing factors.

38. *The Response of* Plasmodium malariae *Infections to Metachloridine, Chlorguanide (Paludrine) and Intramuscular Chloroquine.* Sol B. McLendon, South Carolina State Hospital, and Martin D. Young, Laboratory of Tropical Diseases, National Institutes of Health.

Metachloridine, chlorguanide (paludrine), and chloroquine (intramuscular) were tested against induced infections of *Plasmodium malariae* in neurosyphilitic patients.

Metachloridine given 0.5 gram orally every six hours for 6 days, elicited a slow and unsatisfactory parasitological and clinical response in 10 patients.

Chlorguanide, given 0.1 gram orally three times daily for 10 days, to 7 patients, had a more rapid effect but not as good as has been previously reported for chloroquine given orally.

Chloroquine hydrochloride given in a single intramuscular injection of 225 mgm. had only a temporary effect upon the infection in 4 patients. However, when a single dose of 450 mgm. was injected intramuscularly, the parasitological and clinical response was rapid and compared favorably to that obtained by the giving of 1.5 grams in 3 days orally. Four of the ten patients

had no fevers after the injection and the other six experienced only one fever each. Seventy per cent of the parasites were removed from the blood stream in 24 hours.

The ability to eliminate the infection of *P. malariae* by a single injection of chloroquine can be of much value in treating this type of infection.

39. *Results of Placing* Trichomonas gallinae *from Mourning Doves into Clean Domestic Pigeons.* Robert M. Stabler, Colorado College and Colorado Game and Fish Department (collaborator).

Cankerous doves, and cultures from similar birds, were sent to the writer from the area of the 1950 summer epidemic in doves in Alabama. *Trichomonas gallinae* from these sources, and from positive but non-cankerous doves near Colorado Springs, was put into clean domestic pigeons. Sixteen pigeons received *T. gallinae* from 4 cankerous Alabama doves. None escaped serious oral lesions; 2 died of their infections. Eleven were given 5 strains from the Colorado carrier doves; no lesions developed.

A very virulent strain of *T. gallinae* next was given both to those birds that recovered from their lesions, and to those which developed none at all. To date (26/IX/50) not one of these birds has shown more than fleeting caseation. A control series, with the virulent strain alone, has produced 8 successive deaths; none has recovered. The sublethal infections with *T. gallinae* from the dove (*Zenaidura macroura carolinensis*) appeared to have protected the domestic pigeons (*Columba livia*) from severe involvements due to the subsequent implantations of the highly virulent strain.

40. *Structure and Morphogenesis of* Trichomonas prowazeki *Alexeieff and* Trichomonas brumpti *Alexeieff.* B. M. Honigberg, University of Massachusetts.

Trichomonas prowazeki is found in caudate and acaudate amphibians and in squamate reptiles, while *T. brumpti* appears to be restricted to chelonians. Both species have four anterior flagella, slender costa, well-developed undulating membrane, long free posterior flagellum, discoid parabasal body with a central granule, and crescent-shaped pelta. The trunk of the axostyle is stouter in *T. prowazeki*. *T. brumpti* is somewhat smaller and its costa and undulating membrane are counterclockwise spiral. The parabasal body of *T. prowazeki* is rather thick, uniformly circular, has a dark margin, and is accompanied by two filaments. That of *T. brumpti* is thinner, exhibits a dorsal flattening, has no dark margin, and usually appears to be accompanied by only one filament. The pelta is somewhat stouter in *T. brumpti*.

In both species the old parabasal body is largely discarded and two new ones are formed early in division. The four parental flagella are equally distributed between the daughter individuals. The outgrowth of the posterior flagellum seems to precede the development of the undulating membrane. Either the marginal filament and the cytoplasmic sheath are direct derivatives of the flagellum, or the former two components develop independently and become associated with the flagellum during division. The old axostyle is discarded and two are neoformed.

In *T. prowazeki* the third anterior flagella originate at about the time of formation of the daughter nuclei and the fourth flagella appear still later, but prior to cytokinesis. In *T. brumpti*, the third flagella originate somewhat later, and the fourth flagella do not appear until after cytokinesis.

41. *A New Trypanosome,* Trypanosoma pipientis *n. sp. from the Leopard Frog,* Rana pipiens. Louis S. Diamond, University of Minnesota.

A new, non-pathogenic, monomorphic trypanosome is described from leopard frogs, *Rana pipiens*, collected in the vicinity of Minneapolis, Minnesota.

Body elongate, slender, tapering to sharp pointed extremities. Cytoplasm finely granulated and striated with delicate myonemes. Kinetoplast prominent. Undulating membrane not well developed, flagellar edge paralleled by a myoneme. Average measurements in microns of 45 individuals from experimental frog infections of 14 to 19 days duration are: length exclusive of flagellum 46.2 (range 40.0–56.4), width at nucleus 4.2 (range 2.8–6.0), posterior extremity to kinetoplast 7.0 (range 4.4–8.9), kinetoplast to center of nucleus 13.8 (range 10.3–17.9), center of nucleus to anterior extremity 25.4 (range 21.5–32.7), free flagellum 24.5 (range 17.1–30.4), nucleus 3.0×3.2 (range $2.3–4.1 \times 2.0–4.7$).

This species differs from other similar trypanosomes of frogs, i.e. *T. inopinatum* Sergent, Ed. and Et. 1904, *T. nelspruitense* Laveran 1904, *T. parvum* Kudo 1922, and *T. parroti* Brumpt 1923, in its dimensions, in having a myoneme in the undulating membrane and in being striated; and from *T. karyozeukton* Dutton and Todd 1903 in the first two characters above.

Cultures of the flagellate have been obtained in modified Ponselle's hypotonic medium. Development has been studied in *Rana pipiens* tadpoles and frogs reared from eggs in the laboratory and infected from cultures.

The leech *Placobdella phalera* Graf, 1899 is a natural vector of this parasite.
The trypanosome has also been found in one of seven adult *Rana sylvatica.*

42. *Action of Prodigiosin on Protozoa.* Oscar Felsenfeld, George W. Mast and Sachiko J. Ishihara. Hektoen Institute for Medical Research, Chicago, Ill.

Prodigiosin, a product of *Bacillus prodigiosus,* was discovered by Hettche (Arch. Hyg. u. Bakt., 107: 348, 1932) and identified as a tripyrryl methene. It has been studied as an antibacterial and antimycotic agent but little is known about its action on protozoa.

Prodigiosin was obtained from the Commercial Solvents Corporation. Its LDO for guinea pigs and mice was 1 mgm. per Kg. body weight on intraperitoneal injection. Prodigiosin totally inhibited *in vitro* two strains of *E. histolytica* in concentrations of 15 and 12 microgm. per ml. medium. The same dilutions were inhibitory also for *T. cruzi, T. connorhini, L. tropica* and *L. donovani* in test-tube experiments. In animal experiments using Jones' technic, 650 microgm. per Kg. *per os* prevented artificial infection with *E. histolytica.* Daily injections of the same dose prevented *T. brucei* and *T. equiperdum* infections in rodents.

43. *Experimental Amebiasis in Rats with Cultivated Cysts.* Max C. McCowen and John F. Lawlis, Jr., The Lilly Research Laboratories, Indianapolis, Indiana.

Washed cysts cultivated by a technic similar to that described by Balamuth (1950; personal communication) were fed to 21 day old albino rats by means of a syringe with a 20 gauge oral needle. Using 100,000 cultivated cysts after young rats were preconditioned on a 90% salmon diet, it has been possible to infect 98.8% of the rats used in our studies. Trophozoites recovered at autopsy contained numerous ingested erythrocytes.

This technic for infecting young rats with *Endameba histolytica* has been more satisfactory than the technic described by Jones (1946; Ann. Trop. Med. Parasit., 40: 130–140.).

44. *Blood Parasites in Colorado Band-tailed Pigeons.* Robert M. Stabler and Phyllis Sundquist Limberg, Colorado College and Colorado Game and Fish Department (collaborator); Clyde P. Matteson, Colorado Game and Fish Department.

The band-tailed pigeon (*Columba f. fasciata*), potentially at least, represents one of the important game-bird species in certain of the western states. The writers had an opportunity to make blood films on 109 of these birds taken some 25 miles north of Colorado Springs. The present account is a progress report on the films of the first 66 birds in the series.

Wood and Herman (J. Parasitol., 29(3): 187–196. 1943) and Herman (Bird-Band., 15(3): 89–112. 1944) have recorded the examination of the only two band-tails thus far studied. They reported *Haemoproteus columbae* in one bird, and *Leucocytozoon* sp. in the other. The table summarizes the data from the present study.

Blood parasites in 66 band-tailed pigeons

	Total parasitized	Total with H.	Total with L.	Total with M.	H. and L.	H. and M.	H. alone	L. alone	M. alone	Negative
No.	55	53	12	1	10	1	42	2	0	11
%	83.3	80.3	18.2	1.5	15.2	1.5	63.6	3.0	0	16.7

Legend: H. = *Haemoproteus,* L. = *Leucocytozoon,* M. = *Microfilaria*

45. *Incidence of* Trichomonas gallinae *in Colorado Mourning Doves and Band-tailed Pigeons.* Robert M. Stabler, Colorado College and Colorado Game and Fish Department (collaborator); Clyde P. Matteson, Colorado Game and Fish Department.

Recent reports of canker and death in mourning doves due to *T. gallinae* have served to emphasize the importance of this parasite in native populations. Herman (1941), Harwood (1946), and McCulloch (1950) have described this disease in wild doves, and Dr. Haugen (Wildlife Res. Unit, Auburn), Bailey (Ala. Poly. Inst., Auburn), and Atkeson (Wheeler Refuge, Decatur) worked on an epidemic of dove canker in Alabama in the summer of 1950 (per. comm.). It was felt that the incidence of *T. gallinae* in the two native game-bird columbids of Colorado (band-tailed pigeon, *Columba f. fasciata;* and the mourning dove, *Zenaidura macroura marginella*) should be determined. Trappings some 25 miles north of Colorado Springs in 1948 and 1949 yielded 109 pigeons. Twenty-one (19.3%) showed *T. gallinae,* 88 (80.7%) were negative. None showed evidence of disease. Six birds taken in 1948 were retrapped in 1949. Of these: 1 neg. in '48 was neg. in '49; 1 pos. in '48 was neg. in '49; 2 pos. in '48 were still pos. in '49; and 2 neg. in '48 were pos. in '49.

The senior author then examined 100 mourning doves from within 100 miles of Colorado Springs. *Trichomonas gallinae* was in 23; 77 were negative. Only one was ill. It was found dying of trichomoniasis, its mouth and throat a mass of caseation, its oral fluids swarming with *T. gallinae.*

46. *The Experimental Infection of Young Monkeys* (Macacus rhesus) *with Human Strains of* Entamoeba histolytica. M. J. Miller, Institute of Parasitology, Macdonald College, P. Q., Canada.

Four young monkeys weighing approximately 2½ lbs. each, all harbouring *E. histolytica* as well as several species of non-pathogenic intestinal amoebae, and heavily infected with *Balantidium coli,* were used in this experiment. Treatment with six tablets (19.2 grs.) of Diodoquin each day for ten days eradicated the *E. histolytica* infection; the *B. coli* disappeared on the third day of treatment. Monkey No. 16 received cysts (10–13.5 μ) of *E. histolytica* by mouth from the stool of a human carrier. Two days later it passed cysts of *E. histolytica* of the same size, and retained the infection for 15 weeks at the end of which period it was sacrificed. Monkey No. 17 was given, rectally, an amoebic dysentery stool containing numerous trophozoites of *E. histolytica.* It passed cysts (11–14 μ) of *E. histolytica* in the stool four days later and continued to do so at intervals until it was sacrificed eight weeks later. Monkey No. 18 received cysts (11–16 μ) by mouth and monkey No. 19 was given trophozoites per rectum from the stools of a case of amoebic ulcerative colitis which was passing both cysts and trophozoites of *E. histolytica* in the same stool. Both monkeys passed cysts (11–16 μ) of *E. histolytica* within four days after inoculattion and continued to do so regularly until they were sacrificed six weeks later. At no time during the course of infection did the monkeys show signs of disease. Postmortem examination showed the presence of *E. histolytica* in the large bowel but no evidence of tissue invasion.

47. *The Effect of Centrifugalization on the Survival, Reproduction and Infectivity of* Endamoeba histolytica *trophozoites.* D. E. Wykoff, MSC, USA. (Introduced by E. C. Faust) Tulane University.

Repeated experiments were set up in which amebic cultures were centrifugalized for 15 minutes at speeds of 1,000, 2,000, 2,500, 5,000, 8,000 and 12,500 revolutions per minute respectively equal, under our experimental conditions, to 222, 888, 1,387, 3,210, 8,250 and 20,150 gravities. Thereafter, all the samples were observed microscopically for motility of the amebae and the number of organisms was counted. No significant mortality in any group occurred during centrifugalization. Population studies at 24, 48, and 72 hours revealed a striking similarity of the average curve of growth of the amebae that had been subjected to each of the above speeds and of the non-centrifugalized controls.

Young guinea-pigs were inoculated intracecally each with 100,000 trophozoites from cultures that had been centrifugalized for 15 minutes at 2,500 and 12,500 rpm. At necropsy, 7 days after inoculation, the per cent infectivity in the two groups and the untreated controls was not significantly different. It is concluded that centrifugalization for 15 minutes up to 12,500 rpm does not significantly alter the survival, reproduction and infectivity of *E. histolytica* in Balamuth's medium.

48. *The Effect of Intestinal Infections with* Endamoeba histolytica *on the Liver and Spleen and on the Tissue Distribution of Ascorbic Acid in Normal and Vitamin-C-deficient Guinea-pigs.* Guillermo M. Carrera, Elvio H. Sadun and John L. Bradin, Jr., Tulane University.

Young guinea-pigs were divided into three groups with respect to diet: purified scorbutogenic, purified adequate in Vitamin C and mildly scorbutogenic crude diet. Ten days after being placed on the special diets over one-half of the animals of each group were inoculated with *E. histolytica* trophozoites. Pathologic examinations and determinations of ascorbic acid levels in the plasma, muscle, liver and spleen were done every five days. The weight of liver and spleen relative to body weight was significantly greater among the inoculated and uninoculated animals on the purified scorbutogenic diet and among the infected ones on the purified adequate diet. Histo-pathologic examination showed definite reticulum cell hyperplasia in the enlarged spleens. The infected guinea-pigs on all three diets showed an increased number of neutrophils in the splenic pulp. There was no difference in the histologic appearance of the livers of any of the groups.

Ascorbic acid levels showed a uniformly, very pronounced decrease throughout the experiment among the animals fed a scorbutogenic purified diet, a less pronounced decrease among those on the crude diet and a very small decrease among those on an adequate purified diet. No significant alterations in the content of the tissue ascorbic acid were found as a result of amebic infection.

49. *Host-parasite Relationships among the Digenetic Trematoda.* GEORGE R. LARUE, University of Michigan.
(No Abstract)

50. *Host-parasite Relationships in Cestode Infections, with Emphasis on Host-resistance.* JOHN E. LARSH, JR., University of North Carolina.
(No Abstract)

51. *Evolution of Zooparasitic Groups in the Phylum Nematoda, with Special Reference to Host-distribution.* ELLSWORTH C. DOUGHERTY, University of California.
(No Abstract)

52. *Medical Parasitology in a Changing World. What of the Future?* WILLARD H. WRIGHT, National Institutes of Health.
Presidential Address. (No Abstract)

53. *Life History of Gorgoderid Trematode from* Rana clamitans. J. STEGER HUNT, University of Michigan.
The large finger-nail clam, *Sphaerium simile* (Say) 1816, in pools of certain small streams of the Huron and Raisin River drainages, near Ann Arbor, Michigan, harbors sporocysts of a gorgoderid trematode.
The cercariae produced in these sporocysts are very active. The cercarial body is completely enclosed in a chamber of the tail. Behind this chamber, the tail exhibits a swollen area which does not contain large cells as reported for several cercariae of this type.
Anisopteran and zygopteran naiads, crayfish, and larvae of *Sialis* sp., have been experimentally infected through ingestion of cercariae. These arthropods, when present in pools containing infected clams, are naturally infected with metacercariae in varying percentages.
Metacercariae fed to laboratory-reared green frogs, *Rana clamitans* Latreille, 1802, develop into adult worms in the urinary bladder. At the end of seven weeks, miracidia can be obtained from naturally voided urine of experimentally infected frogs. So far, other species of frogs have proved resistant to infection with this trematode.

54. *An "Acanthocolpid" Trematode from the Sturgeon of the Wabash River.* R. M. CABLE, Purdue University.
A trematode representing a new genus and species and closely related to species of *Deropristis* and *Dihemistephanus sturionis* occurs in numbers in the spiral valve of sturgeon from the Wabash River, Indiana. The fluke lacks the cervical and dorsal hump spines of *Deropristis* and the circumoral row of *Dihemistephanus sturionis* but otherwise resembles these species very closely. Evidently these trematodes constitute a natural group of subfamily rank and should be excluded from the Acanthocolpidae. Furthermore, discovery of the present species indicates that *Dihemistephanus sturionis*, a form whose generic position has been doubtful, should be excluded from the genus *Dihemistephanus*.

55. *Studies on the Biology of* Acetodextra amiuri (Stafford, 1900) (Trematoda: Heterophyidae). KENNETH W. PERKINS, Purdue University.
The ovary of catfish is the natural site of infection by adults of *Acetodextra amiuri*. They often occur in large numbers, over 2000 being recovered from a single fish. Evidently, they destroy large numbers of eggs in the host's ovaries; young worms have been observed within the eggs and the intestine of older ones as well is filled with yolk. There is no indication that the adult trematodes discharge eggs within the ovary. Instead, it seems that they accumulate in the uterus and that gravid worms are expelled when the fish spawns. An unusual adaptation for egg dispersal has been observed when gravid worms are placed in tapwater. The body curves ventrally and, as a result of muscle contraction, the uterus ruptures through the dorsal body wall, projecting a stream of eggs with considerable force. This process almost always occurs within one minute after worms are placed in water, even after being held in saline for several days. Eggs obtained in this manner and placed in aerated water became embryonated but did not hatch. Attempts to infect snails and trace the life cycle further are in progress.

56. *Sporocyst of* Echinostoma revolutum (Froelich, 1802). HELEN M. CHURCHILL, Hollins College, Virginia.
The life cycle of a strain of *E. revolutum* from *Helisoma trivolvis* was completed experimentally in the same species of snail. The miracidium metamorphoses into a sporocyst, not a redia, as Johnson (1920) thought. Mature, fully-extended sporocysts are pyriform, but the

slender neck can be contracted to varying degrees. Twenty-eight whole mounts of 41-day-old sporocysts varied in length from 130 μ to 473 μ (av. 214 μ) and in maximum width from 65 μ to 130 μ (av. 91 μ). A small number of first generation rediae develop in each sporocyst.

57. *A New Genus and Species of Caryophyllaeidae (Cestoda) from Fishes.* Jacob H. Fischthal, Harpur College, State University of New York, Endicott, New York.

A new genus and species of unsegmented tapeworm belonging to the order Pseudophyllidea, family Caryophyllaeidae, was found in northwest Wisconsin cyprinid fishes. Five of 15 bluntnose minnows, *Hyborhynchus notatus,* from Little Sand Lake, Washburn County, contained a total of five mature and one immature specimens; one of five western golden shiners, *Notemigonus crysoleucas auratus,* from Beaver Brook, Washburn County, harbored three mature and three immature worms. It is necessary to emend slightly the diagnosis of the subfamily Caryophyllaeinae in order to assign the new form to its proper place. The name *Pliovitellaria wisconsinensis* is proposed for this caryophyllaeid.

The scolex is poorly defined, varying little in shape, and bearing one pair of acetabular-like bothria. The cirrus opens into the utero-vaginal canal before it reaches the surficial atrium. The ovary is H-shaped and entirely medullary. The uterine coils extend only to the anterior margin of the cirrus sac reaching a maximum longitudinal extent of three-fourths to one-half that of the testicular field. A terminal excretory bladder and an external seminal vesicle are present. The post-ovarian vitellaria are extensively developed.

58. *A Precociously Developed Brachylaemid Metacercaria Within a Sporocyst.* Martin J. Ulmer, Iowa State College.

Anguispira alternata, the land snail serving as first and second intermediate host for the trematode, *Postharmostomum helicis,* may also harbor the sporocyst, cercarial, and metacercarial stages of a related brachylaemid, studies on the life cycle of which are now in progress. This brachylaemid is distinguished from *P. helicis* by the possession of ciliated excretory ducts, straight intestinal crura, and metacercariae normally localized wihtin the renal chamber of the molluscan host. Sporocysts of this species, however, occasionally contain large metacercariae, which, in addition to their size, may be distinguished from cercariae by the lack of a caudal appendage and by the presence of concretions within greatly expanded excretory siphons.

59. *Germ Cell Cycle in the Trematode Family Brachylaemidae.* Arthur E. Woodhead, University of Michigan.

From a small snail *Succinea retusa,* collected in October, 1932 and reported by the writer in 1936, an account was given of the finding of 21 small sporocysts. Re-examination of this material sheds additional light on the problem of reproduction in branching sporocysts. It is now possible to state definitely that within the "germ-balls," which represent the 2nd generation, precocious development takes place. The precocious germ-balls show oögenesis with polar bodies and reduction division, spermatogenesis with reduction and formation of tailless sperm, fertilization and formation of a 2-nucleated cell.

Germ-balls of the succeeding generation are developed from the 2-nucleated cells and form small germ-balls which are cut off and liberated at the breakup of the "precocious" germ-ball. As yet we are unable to state how many more generations of embryos are formed before the production of cercarial embryos.

60. *Artefacts and Exoerythrocytic Stages of* Plasmodium cynomolgi *in* Macaca mulatta. Frederick Coulston and Frances O. Robinson, The Christ Hospital Institute of Medical Research.

Sixty monkeys have been used in these studies; 50 were inoculated with sporozoites while 10 were controls. For each experimental procedure, a suitable control was used. Laporatomies were done on many normal and infected monkeys, either to remove the inoculation sites in the liver or spleen, or to sample the tissues at different times ranging from 30 minutes to 11 months. Most monkeys were sacrificed and all important tissues were taken for histological study.

Tissues were fixed in Zenker-formalin or Carnoy and embedded in paraffin or celloidin and paraffin. Serial sections were made and stained by the Maximow and Wright methods and the MacNamara, Shortt-Cooper, or Coulston modifications of the Giemsa method. Detailed studies have been made only on the liver, spleen, bone marrow, skin and lung.

Four distinct kinds of bodies were observed in the liver and spleen, 2 of which will be demonstrated:

1. Forms, morphologically like the pre-erythrocytic stages of avian malaria, found in the Kupffer cells of monkeys infected with *Plasmodium cynomolgi* but not in normal monkeys.

2. Bodies, resembling some of the 6 to 10 day exoerythrocytic stages of *Plasmodium cyno-*

molgi described by others, observed in the liver and spleen of both normal and infected monkeys. Certain of these tissue forms were probably platelet agglutinations and occurred as distinct groups of individual platelets or as masses with confluent boundaries. Carnoy fixation and the Shortt-Cooper technique, stained these forms pale blue with red inclusions or pink with dark red inclusions.

61. *Observations on the Life History of* Ascaris columnaris. J. F. A. SPRENT, Ontario Research Foundation, Toronto, Canada.

The behavior of *Ascaris columnaris* larvae in the tissues of white mice was compared with that of the larvae of *A. lumbricoides, Parasascaris equorum* and *Neoascaris vitulorum.* They were found to differ from the other species in the more rapid rate of migration through the liver and in their ability to pass from the lungs into the general circulation by which they appear to be distributed to various organs as early as the 8th day after infection. This behavior seems to result from their remaining the same size for the first 8 days of infection. The observations of Tiner (J. Parasitol. 1949. 35. Suppl. p. 13) that the larvae become encapsulated in the tissues were confirmed. These larvae were found to remain alive for 5 months in the mouse and grew to a length of 1.8 mm. The larvae remained alive after infected mouse carcasses were subjected to putrefaction for several days, refrigeration at −20° C. up to 4 weeks, and peptic digestion. Natural infection with mature *A. columnaris* was found in the skunk *(Mephitis m. mephitis),* the marten *(Martes a. americana),* the fisher *(Martes p. pennanti),* and the black bear *(Euarctos a. americanus).*

Mature females varied from 10 mm in the skunk to 24 mm in the bear. No natural infection of wild rodents was discovered in 250 specimens. Previous infection of mice with *A. columnaris* produced resistance to infection with *A. lumbricoides.*

62. *An American Host Record for the Russian Sturgeon Nematode,* Cystoopsis acipenseri *Wagner, 1868.* M. B. CHITWOOD AND ALLEN MCINTOSH, Zoological Division, Bureau of Animal Industry, U. S. D. A.

In May, 1950, a young sturgeon, *Acipenser transmontanus* Richardson, was received with a request for identification of a small nematode found in numerous cutaneous blister-like cysts. The sturgeon had been taken from the Columbia River at Bonneville Dam, Oregon, by Mr. Ivan Donaldson. On examining the fish the blisters were found arranged mostly along the lateral and ventral plates. Each blister examined contained a small cylindrical male and a female with a large spherical body, characteristic of the genus *Cystoopsis.* For the most part the measurements of our material agree closely with the data given by Janicki and Rasin (1930) for *Cystoopsis acipenseri,* but, there is a difference in egg size, 46 μ long as against 64 μ for the American material. However, with no Russian material available for comparison the writers have for the time being identified their material as *Cystoopsis acipenseri.* This interesting parasite is listed in some authoritative works with the nematodes of uncertain systematic position, but the monotypical genus has been placed in the family Cystoopsidae Skrjabin, 1923, superfamily Trichuroidea. It is clear beyond a doubt that the species is correctly placed.

63. *The Early Developmental Stages of* Onchocerca volvulus *in Guatemalan Species of* Simulium. COLVIN L. GIBSON, National Institutes of Health, U. S. Public Health Service and Pan American Sanitary Bureau, Guatemala.

More than 6,000 flies of the species *Simulium ochraceum, S. metallicum,* and *S. callidum* were dissected or sectioned serially at various intervals of time after feeding on human subjects infected with *Onchocerca volvulus.* Since laboratory-reared simuliids consistently refused to bite, wild-caught flies were used. Less than 1.0% of a control series of wild flies, taken concurrently with those used for the experimental infections, showed developmental forms in the thorax, whereas up to 15.0% of the experimentally exposed flies became infected. There was a heavy mortality of exposed flies on the second and third days after the infective meal, apparently due to hyperinfection.

Microfilariae can develop to the "sausage stage" in all three species of *Simulium* used in the experimental infections. Within 24 hours after ingestion, some microfilariae migrate into the thoracic muscles. Those which do not reach the thorax die and are later absorbed. Early "sausage forms" can be distinguished in the thoracic muscles within 48 hours. At 72 hours differentiation of the digestive tract begins, and by the fourth day the esophagus and intestine are well differentiated, the rectal plug is distinct, and the subcuticular cells have been organized into a distinct muscular layer. The intestinal lumen appears during the fifth day. On the eighth day there is an ecdysis (apparently the second) at which time the rectal plug and lining of the esophagus are shed, and the larva takes on the appearance of an immature metacyclic form.

64. *The Distribution of Alkaline Glycerophosphatase in the Muscle of Rats Infected with* Trichinella spiralis. W. L. Bullock and D. P. Gangi, University of New Hampshire.

Alkaline glycerophosphatase distribution was studied in the tongue and diaphragm of *Trichinella spiralis* infected rats by means of the Gomori technique. Normal, uninfected muscle shows little positive reaction by this method except in the capillaries and the endothelium of some of the smaller blood vessels. In the infected animal there is an intense concentration of this enzyme in the degenerating muscle tissue associated with the inner cyst wall. The enzyme was found in all infected rats studied from 12 days post infection to 44 days and appears to be associated with the degeneration of the fiber produced by the infection.

The eosinophiles in the region of invaded fibers, also gave a pronouncedly positive reaction for alkaline phosphatase. The eosinophiles relatively remote from the site of infection were negative as were those of normal tissue. The presence of phosphatase in those cells near the site of infection gives evidence of some metabolic change in the eosinophiles as they assume their role in the infiltration processes.

65. *Some Odd Scolecidans.* B. G. Chitwood, Catholic University of America. (No Abstract)

66. *The Life-Cycle of* Monoecocestus sigmodontis *(Cestoda: Anoplocephalidae) from the Cotton Rat* (Sigmodon hispidus). Dorothy M. Melvin, Rice Institute.

As in the case of other anoplocephalid tapeworms, the intermediate hosts of *Monoecocestus sigmodontis* were found to be free-living mites of the superfamily Oribatoidea. The mites were obtained from grass and top soil by means of a modified Berlese light trap, and eggs of *M. sigmodontis* were collected from the feces of infected rats, and from proglottids of worms obtained at autopsy. Mites and eggs were placed together on moistened bits of filter paper in mason jars and left for several days. At the end of this time, soil and grass heated to destroy predators, were added to the cultures for food. Mature cysticercoids were found in the body cavities of 6 species of oribatids after 7 to 8 weeks at temperatures of 28° C. to 30 C. Up to 13 mature cysticercoids were found in a single mite. Infected mites were fed to uninfected laboratory-reared cotton rats after being cracked to facilitate the release of the cysticercoids. Eggs were found in the feces of the rats about 8 weeks after infection. This is the twelfth anoplocephalid tapeworm life history to be reported.

67. *A Vole* (Microtus) *an Important Natural Intermediate Host of* Echinococcus granulosus. Everett L. Schiller and Robert Rausch, Arctic Health Research Center, U. S. Public Health Service, Anchorage, Alaska.

Autopsies conducted during preliminary parasitological investigations on St. Lawrence Island in May, 1950 revealed the presence of *Echinococcus granulosus* in 5 of 7 arctic foxes *(Alopex lagopus)*. Results of similar examinations of 26 dogs were negative for this cestode.

During the latter part of August, 1950 the native population of the villages of Gambell and Savoonga were skin tested with non-specific *Echinococcus* antigen. Positive reactions were encountered in 20 per cent of the 126 persons tested at Gambell and in 26 per cent of the 106 persons tested at Savoonga.

Continued helminthological studies of the mammalian fauna of this Island during the latter part of August and early September, 1950 disclosed infections of larval *E. granulosus* in the tundra vole, *Microtus oeconomus innuitus* Merriam. Of 587 voles examined, 14 were infected. This vole was very abundant, apparently at a cyclic high level of population density during 1949 and 1950. Other microtine rodents were scarce at this time and could not be collected for comparative study. No larval stages of *E. granulosus* were found in the examination of 85 ground squirrels *(Citellus)*.

The larval stages of *E. granulosus* occurring in the voles were of typical appearance and commonly involved the liver and mesenteries. The larval forms approached a maximum size of 3 cm. in diameter and were often distributed throughout the abdominal cavity.

Reindeer, the only obvious intermediate host for *E. granulosus* on St. Lawrence Island are no longer killed for food in an effort to increase the numbers of these animals. It therefore seems necessary that other factors involved in the epidemiology of human infections be considered. The St. Lawrence Island people eat a considerable quantity of native green plants (identity as yet undetermined) during the summer months. These are commonly consumed raw and unwashed as they come from the field. In view of the abundance of arctic foxes, it is likely that there is much contamination of this type of vegetation. It is probable that the arctic fox–vole–green plant–human relationships play an important part in maintaining the natural and accidental infections with *E. granulosus* on the Island.

68. *Parasitic Turbellarians from Echinoderms.* H. W. Stunkard and J. O. Corliss, New York University.

A new species of rhabdocoel turbellarian has been recovered from the common sand-dollar, *Dendraster excentricus,* at La Jolla, California. Study of living specimens, of whole mounts, and sectioned material showed that the parasite belongs in the genus *Syndesmis,* family Umagillidae Wahl, 1910 (syn. Anoplodiidae v. Graff, 1913), and examination of the literature indicated that it could not be referred to any previously described species. The new species, the fourth to be reported from the western hemisphere, will be described and its systematic position discussed.

The family Umagillidae, containing some eleven genera and twenty-one valid species, forms the largest parasitic group in the class Turbellaria. The members are all endoparasites living in various echinoderms or, in one instance, in sipunculid worms. The new species is the first parasitic rhabdocoel recorded from the flattened, sand-dollar type of echinoid. Since the monograph by von Graff in 1913, the number of genera and species in the family has trebled but there has been no detailed systematic account of the group. The need for restatement of family, subfamily, and generic characters will be pointed out. In revision, a classification is proposed in which three subfamilies are recognized: Umagillinae Wahl, 1910, Collastominae Wahl, 1910, and Bicladinae n. subfam. The possibility of a fourth subfamily will be discussed. Minor changes are indicated at generic and subgeneric levels.

69. *Studies on the Host-Parasite Relations of* Hymenolepis nana *var.* fraterna. W. S. Bailey, Alabama Polytechnic Institute.

Adult grain beetles, *Tenebrio molitor,* were exposed to the eggs of *Hymenolepis nana* var. *fraterna* and dissected after 14 to 30 days. From 1 to 229 cysticercoids were recovered from each of 228 of the 367 beetles dissected. These cysticeroids differed greatly in morphology from those developing in the villi of the mouse intestine, especially in the size and structure of the wall surrounding the scolex and in the presence of a characteristic caudal vesicle. Eighty-one per cent of 953 cysticercoids developed to the adult stage when fed to previously uninfected mice.

The immunity induced in mice by the development of cysticercoids in the intestinal wall did not interfere with the establishment of worms from a superimposed infection with cysticercoids from beetles. Likewise the presence of adult worms which developed from cysticercoids from beetles failed to prevent the establishment of worms from a second infection of the same type. There was no marked difference in the number of cysticercoids found in the intestinal villi of mice infected 6 days earlier with cysticercoids from beetles and the number found in the previously uninfected controls.

Histological sections prepared from the second quarter of the small intestine of mice following a single egg infection or a superimposed egg infection were employed in the study of the host-tissue response to the larvae. Following the initial infections a slight cellular infiltration was found to occur by the end of the 3rd day. This was rather marked by the time the cysticercoids were completely developed at the end of the 4th day. The most numerous cells were polymorphonuclear leucocytes, some of which were eosinophiles.

On examination of tissue sections from 8 mice given a second egg infection 5 or 10 days after the initial one and killed after 18 to 72 hours, larvae from the second infection were found to have penetrated the mucosa in only 1 mouse. The number present in this mouse was much smaller than that found in the previously uninfected control killed at the same time, and a more rapid cellular response had been elicited around the larvae than was found in mice following initial infections.

70. *Characters for Distinguishing the Sexes of Live Tropical Rat Mites in Various Stages of Development.* J. Allen Scott and Ellen Blynn. University of Texas Medical Branch, Galveston, Texas.

In the course of experimental studies on the tropical rat mite *Bdellonyssus* (*Liponyssus*) *bacoti,* as vector of the filarial worms of the cotton rat, the need has arisen for a method of distinguishing between the sexes of live mites in various stages of development. When the adults have recently fed, the males are easily distinguished from the females by their smaller size and elongate form. When unfed the sexes of adults are not so easily distinguished, and in this condition it is not always possible to determine whether the males are in the deutonymph or the adult stage. The above distinctions can all be made by observation without magnification or special preparation. For confirmation of these determinations and to distinguish between the sexes of the nymphs, the mites are mounted in water under a cover glass and examined with a 16mm. lens. If the mites are then dried on filter paper, they recover without injury. The characters of greatest value in this type of examination, especially in the case of well fed mites whose ventral

plates are obscured, are the chelicerae and the peritremes. The distinguishing features of these structures will be illustrated.

71. *An Instrument for Microscopic Examination of Objects in Closed Vessels.* JORDAN LEFLER AND PAUL V. GUSTAVSON, University of Washington.

Direct microscopic observation of small objects immersed in fluid in closed vessels is impeded by the shape of the vessel, droplets of condensed moisture, and incompatible working distances. An instrument using two 90° reflecting prisms allows examination from below and overcome some of these disadvantages. This device is used to best advantage with a dissecting microscope with magnifications from 10 to 60 diameters. Sterile *in vitro* experiments on invertebrates and tissue cultures can be followed without opening the container, and risk of contamination can be avoided.

72. Preliminary observations on the occurrence of water-mites on insects in the Duke Forest. ROBERT M. CROWELL, Zoology Dept., Duke University, Durham, North Carolina.

In an attempt to determine the host-parasite relationships of the water-mites in the vicinity of Duke University, mature and immature insects were collected in the Duke Forest between May, 1949 and September, 1950. Nearly 800 individuals representing 7 orders and at least 12 families of insects were examined as follows: Plecoptera, adults 51, nymphs 31; Odonata, damsel flies 40, dragonflies 21; Ephemerida, adults 23, nymphs 23; Hemiptera, Gerridae, adults 143, nymphs 27; Belostomidae, adults 4; Neuroptera, larvae 10; Trichoptera, adults 68; Diptera, Tipulidae 30, Tendipedidae 33, Simulidae 11, undetermined dipterans 280. Examination of these aquatic and semi-aquatic insects has revealed a very low incidence of infestation; only 7 (0.9%) of these individuals were infested with water-mites. In these collections parasitized individuals were found among the adult Gerridae, the Odonata and the Trichoptera. Periods of bloom in the occurrence of adult water-mites in Duke Forest have not been associated with increased incidence of parasitic stages on wild insects examined.

From cultures of pond debris removed to the laboratory, the pre-adult stages, including attached parasitic larvae, of an undetermined species of the family Pionidae have been recovered. The larvae of this form parasitize midges of the family Tendipedidae (= Chironomidae). The temporal relationships of these mites and their hosts have not been determined.

73. *Distribution and Host Relationships of a Mite Parasitic in Fresh-water Clams.* ARTHUR G. HUMES, Boston University; HUGO A. JAMNBACK, University of Massachusetts.

Previously known only from a few scattered records in Ontario and Michigan, *Najadicola ingens* (Koenike) is now reported from 43 localities in Massachusetts, Rhode Island, Vermont, New Hampshire, Maine, Quebec and New Brunswick. These distribution data are based upon an examination of 3077 fresh-water clams from 74 localities in New England and adjacent areas of Canada. The mite occurs most commonly in *Anodonta cataracta* Say, less frequently in *Elliptio complanatus* Solander, and only occasionally in *Lampsilis radiata* (Gmelin).

The smaller and presumably younger *A. cataracta* and *E. complanatus* are parasitized more often than larger individuals. In *A. cataracta* the mites occur almost always in the outer suprabranchial chambers, but in *E. complanatus* in the inner suprabranchial chambers. In *L. radiata* the mites occur about equally in the four suprabranchial chambers. Usually one male and/or one female parasitize a single clam, although in *L. radiata* several of both sexes may be present.

The walls of the suprabranchial chambers containing mites almost invariably bear numerous papillae. The presence of mites in gravid gills apparently interferes with the normal use of the gills as marsupia.

74. *The Life Cycle and Parasitic Habit of the Chigger Mite* Hannemania dunni *Sambon, 1928, a Parasite of Amphibians.* K. E. HYLAND, Duke University.

Chigger mites of the genus *Hannemania* are parasitic during the larval stage on amphibians exclusively. In the laboratory the life cycle of one species, *Hannemania dunni,* found in the Duke University Forest, has been completed. The developmental stages consist of egg, deutovum, larva, nymphochrysalis, nymph, imagochrysalis, and adult as in other trombiculids. Nymphs and adults are free-living and feed on arthropod eggs; those of *H. dunni* have been fed successfully on collembolan eggs. (The collembolans were obtained in culture from L. J. Lipovsky of the University of Kansas.)

In contrast with the usual ectoparasitic habit of the family Trombiculidae, the larvae of this genus are generally found beneath the skin of the host. Their presence is indicated by a small red excrescence about 1 mm. in diameter at the site of each mite. Unengorged larvae when applied experimentally to a host are capable of penetrating and becoming completely embedded

in the skin within two hours. The length of time spent as a parasite may vary considerably; in one instance larvae remained under the skin for more than six months. If the host dies the larvae actively emerge from the skin to continue their life cycle. Apparently they are not trapped in the host because they have been observed to emerge from living amphibians. One larva completed engorgement in 4½ hours without going beneath the skin and developed normally.

75. *Studies on the Life History and Pathogenicity of the Intestinal Nematode,* Strongyloides papillosus *in Calves.* Halsey H. Vegors and Dale A. Porter, U. S. Bureau of Animal Industry.

Grade Jersey calves were infected with filariform larvae of the threadworm, *Strongyloides papillosus.* Eggs appeared in the feces in from 9 to 11 days after exposure. The mode of infection had little effect on the prepatent period. However, calves were more readily infected when larvae were placed on the skin than when they were given orally. Skin penetration of the larvae caused slight local inflammation at first application but reexposure resulted in edema of the skin with serum exudation and scab formation at the site of application. The worms in the intestine produced catarrhal inflammation with petechial and ecchymotic hemorrhages, especially in the duodenum and jejunum. Clinical symptoms appeared in 12 calves, 7 of which died as a result of exposure to large numbers of larvae. Calves 4 to 5 months old were more resistant to larger numbers of larvae than were calves less than a month old. The most characteristic symptoms were intermittent diarrhea, the droppings containing mucus and blood in some cases; and loss of appetite, loss of condition, and retarded growth. Heavily infected calves made daily gains which were 33 to 79 per cent less than uninfected controls.

76. *The Role of the Protein Coat in the Development of the Ova of* Ascaris lumbricoides var. suum. B. J. Jaskoski, Notre Dame University and The Creighton University.

The protein coat of the egg envelope of swine-ascarid ova was removed with a solution of antiformin. The rate of development of de-coated and normal eggs from the uncleaved state to the motile-embyro stage was found to be almost identical at optimum temperature. At temperatures above optimum (31.1° C.), de-coated ova exhibited a decided resistance to the damaging effects apparent among normal eggs. Certain commercial detergents were effective in the complete inhibition of cleavage. A solution of 5 per cent Duponol 80 was the most effective inhibitor tested. A combination of 5 per cent Duponol 80 plus 1 per cent phenol was the most effective combination tested. The cleavage-inhibiting effects were decidedly enhanced by an increase in temperature from the optimum for embryogeny. The effect of the detergent was apparently to increase the permeability of the *Ascaris* egg-shell. The protein coat serves as an important auxiliary barrier against the passage of chemical agents through the egg membranes. Hatching of swine-ascarid ova was successfully accomplished *in vitro.* A solution of 5 per cent Duponol 80 was the most effective solution tested in inducing extra-corporeal hatching. Oxygen consumption of de-coated and normal ova during embryogeny was found nearly identical in rate and amount.

77. *An Outbreak of Parasitic Gastroenteritis in Feedlot Lambs.* B. Schwartz, A. O. Foster, J. E. Peterman, J. L. Wilbur, Jr., and K. C. Kates. U. S. Bureau of Animal Industry.

A lamb-feeding establishment in Nebraska recently suffered an epizootic costing the lives of more than 2,200 out of 17,000 ovines. About one-fourth of the lambs were lost from one shipment of 6,900 received from southwestern Texas in May. Surviving lambs were emaciated and did not finish for slaughter profitably. One of us (J. E. P.) reported to the Bureau his opinion that the epizootic was caused by parasites. Upon investigation, when 50 to 100 lambs were dying daily, the diagnosis of parasitic gastroenteritis was confirmed.

The clinical picture was one of extreme emaciation, profuse scouring, anemia, and heavy death losses. From postmortem and fecal examinations, gross parasitism was evident, with trichostrongylosis and haemonchosis predominating, and complicated by lungworm infections. Laboratory examinations showed the presence of the following parasites: *Haemonchus contortus, Ostertagia circumcincta, Trichostrongylus axei, T. columbriformis, Nematodirus spathiger, Oesophagostomum columbianum, Trichuris ovis, Dictyocaulus filaria, Moniezia expansa, Thysanosoma actinioides, Oestrus ovis* and few coccidia. The gastrointestinal tracts and lungs of the affected lambs showed the typical pathological changes associated with the parasites involved. There was no evidence of clinical coccidiosis.

The losses were restricted to lambs that had been grazed for successive periods of 2 to 3 weeks on 20-acre alfalfa pastures, and the peak of the epizootic coincided with the so-called second cropping of pastures that had been rested for 2 to 3 weeks to permit regrowth of forage after the first cropping.

Inasmuch as parasitic worms are rarely a cause of serious losses among feedlot lambs, the aforementioned epizootic merits special analysis and consideration.

78. *A Description of the Larval Stages of* Litomosoides carinii *Occurring in the Intermediate Host.* J. Allen Scott. University of Texas Medical Branch, Galveston, Texas.

The stages of the life history of *Litomosoides carinii* which occur in the tropical rat mite are described in this paper. Since the stages which occur in the cotton rat have previously been described, the description of the life cycle is completed by these observations. This represents the first complete description of the life cycle of any filarial worm. As in the case of other species of filarial worms, the microfilaria is considered to be the first larval stage. In the tropical rat mite the microfilaria continues its development and molts into the second or sausage stage. After considerable growth and development this stage molts into the third stage larva which rapidly becomes infective. At approximately 25° C this phase of the cycle is usually completed in about fifteen days, but a delayed development of certain individuals is of especial interest. On transfer to the cotton rat, the third stage larva continues its development, molts to the fourth larval stage and later to the adult stage. Microfilariae appear in the peripheral blood about fifty-one days after infection thus the complete cycle requires about sixty-six days.

79. *Filariasis in American Samoa I. Persistence of microfilariae in individuals not exposed to reinfection.* Leo A. Jachowski, Jr. (Naval Medical Research Institute); Gilbert F. Otto (The Johns Hopkins University); James D. Wharton (Naval Medical Research Institute).

Surveys in 1950 to determine the incidence of microfilaremia in Samoans included a group of nurses having 4 to 52 months residence at the Samoan Hospital. Anti-mosquito measures have made transmission of *Wuchereria bancrofti* in the vicinity of this hospital highly improbable. Consequently, the nurses probably are not reinfected during their period of training. The incidence of microfilaremia in nurses with residence at the hospital for as long as 32 months corresponded to that observed in women of the same age group in various villages. However, the number of nurses with residency of 40 to 52 months with microfilariae was considerably lower than expected.

Extending these studies, a group of 134 Samoans living on Oahu, Hawaii also were examined for microfilaria. None of 62 Samoans who were born and reared in Hawaii showed any blood infection. Therefore, transmission of filariasis in Hawaii, if it occurs at all, is of little importance. While only eight of the 72 individuals born in Samoa were infected, all had been in Hawaii for less than six years. There were no indications of the infection in the population who had come to Hawaii more than six years prior to the survey.

It appears that microfilaremia may persist for at least five years in persons who are not exposed to reinfection. However, it would appear that the microfilariae disappear within ten years after the last infection.

80. *Isolation Cultures of* Neoaplectana glaseri. V. H. Dropkin, Roosevelt College.

Cultures of individual families of this nematode were attempted in order to study its genetics. Pregnant females were isolated from stock cultures into a variety of media and their pregnant daughters were again isolated for inbred lines. (1) Culture tubes of autoclaved beef liver and agar into which a single female was introduced aseptically showed poor growth. A few F–1 offspring, but no F–2 offspring developed. (2) Culture tubes of rather dilute chick embryo juice, treated aseptically, supported good growth of F–1 offspring. A few F–2 offspring resulted. (3) Non-sterile techniques with agar plus nutrient on microscope slides yielded the best results. The medium consisted of a drop of 1% agar in which a small piece of fresh rat kidney was imbedded. The slides were kept in moist chambers. Of 21 F–1 females, 15 produced F–2 offspring, and 8 of these families grew to the adult stage. But no F–3 offspring have yet been produced. This method offers good possibilities for genetic studies.

81. *The Effects of Some Iodine Compounds on Horse Strongyle Larvae in Manure.* Norman D. Levine, University of Illinois.

The effect of 61 organic and inorganic iodine compounds on the development of horse strongyle larvae in manure was studied. In general, aryl or heterocyclic iodine compounds in which the iodine was attached directly to a ring carbon atom were much less active than inorganic, aliphatic or other compounds in which the iodine was not attached to a ring carbon.

Compounds which prevented the development of larvae at a concentration of 0.0005 M. or less were ammonium iodide, red mercuric iodide, potassium iodide, sodium iodide, potassium iodate, potassium metaperiodate, ethylene iodide, iodoacetic acid, beta-iodopropionic acid, ethyl-beta-iodoproprionate, trimethylene iodoacetate, pyridine methiodide, gamma-collidene methiodide, piperidine hydroiodide, N, N-dimethyl piperidine iodide, 1, 2, 6-trimethyltetrahydroquinoline

hydroiodide, triethylbutyl ammonium iodide, trimethyl sulfonium iodide, tetramethyl arsenic iodide, triphenylmethyl phosphonium iodide, diphenyl iodonium iodide and *bis*-(*p*-iodophenyl) iodonium iodide.

82. *Results of Additional Experiments in Which Small Amounts of Phenothiazine was Fed in Pure Infections of the Nodular Worm in Calves.* Roy L. Mayhew, Louisiana State University.

In former experiments (Mayhew 1949, J. Parasitol. 35: 12 Sup) it was shown that phenothiazine stopped egg production of (*Oesophagostomum radiatum*) when ½ and 1½ grams was fed daily for 6 and 14 day intervals. One-half gram was effective in stopping egg production when fed 14 days. Because of a number of questions left unanswered by the former experiments, additional ones have been carried out. It has been possible to keep one of the animals that had become negative to nodular worm eggs as a result of feeding ½ gram for 14 days, under conditions preventing reinfection. The animal became positive after 6 weeks and the number of eggs reached a maximum of 3.5 eggs per gram of sediment. A total of 9 calves have been inoculated from this animal over a period of 4½ months. This indicates that continuous or intermittent feeding of the drug is necessary. An experiment was conducted in which ½ gram was fed 14 days with the result that the eggs became abnormal and disappeared on the 10th day after the first feeding. Two experiments have been carried out in which ½ gram was fed for 7 days with the result that all the eggs became abnormal, but did not disappear and rapidly became normal after feeding was discontinued.

In order to secure information on the minimum amount that will produce changes in and cessation of egg production, two calves have been fed a series of increasing amounts beginning with .1 gram for 7 days. No changes were noted when .1 and .2 grams were fed. When .3 gram was fed marked changes were noted in the eggs of one animal and the eggs quickly returned to normal when feeding was discontinued. No changes were observed in eggs of the other animal. When .4 gram was fed an increase in the number of abnormal eggs was noted in both animals and the eggs rapidly returned to normal after the feeding of the drug was discontinued. Another animal was fed .3, .4 and .5 grams in a succession of experiments with the result that abnormal eggs appeared in all the experiments followed by a rapid return to normal after the feeding was discontinued. Some experiments have been conducted to determine if a tolerance for phenothiazine can be developed when fed in small amounts. One of the calves used in the .1 to .4 gram experiments described above was continued in a succession of .5, .6 and .7 gram experimental 7 day feedings, with the results that the eggs became abnormal in all the experiments, but the animals did not become negative. A series of experiments was also carried out in which .5 gram was fed for 7, 10, 12 and 14 day periods. In the 7, 10 and 12 day experiments, all the eggs became abnormal, but the animal did not become negative in either. The 14 day experiment resulted in abnormal eggs and the animal becoming negative.

83. *A Preliminary Report on Feeding Small Amounts of Phenothiazine During the Prepatent Period in Pure Infection of the Nodular Worm in Calves.* Roy L. Mayhew, Louisiana State University.

One and one-half grams of phenothiazine was fed daily during the first two weeks of the prepatent period to two calves. Eggs were recovered from the manure of both calves on the 38th day after inoculation. The number of eggs recovered by fecal examination indicated the presence of a relatively small number of adults in the case of one animal and a considerable number in the other. No symptoms of parasitism were observed in either animal.

One calf was fed 1½ grams of phenothiazine daily during the 2nd two weeks of the prepatent period. The first eggs appeared on the 51st day after inoculation and the resulting numbers of eggs remained relatively low during the following eight weeks.

84. *The Use of Sulfonamides for the Control of Trichinosis in White Mice.* Bernard B. Riedel, Southwestern College, Winfield, Kansas.

Sulfanilamide, sulfaquinoxaline and sulfamerazine were studied to determine their therapeutic nature for the control of trichinosis in white mice.

An initial experiment was conducted on groups of mice individually infected with 125 ± 5 larvae. Treatment began immediately after infection, and the experiment was terminated after 30 days. The results showed that continuous feeding of a 0.25 per cent sulfaquinoxaline feed did not produce a larval reduction. Feeds containing 2.0 per cent of sulfanilamide and 1.5 per cent of sulfamerazine produced larval reductions of 54.5 and 55.8 per cent, respectively. A feed containing a combination of sulfanilamide (2.0 per cent) and sulfamerazine (1.0 per cent) reduced the larval count 73.0 per cent.

A second experiment was performed to determine if the sulfonamides would protect white mice from a lethal dose of 1300 larvae injected directly into the stomach by means of a stomach tube. Among control mice only 11.1 per cent survived the 50-day experimental period. Sulfanilamide (2.0 per cent) and sulfamerazine (1.5 per cent) effected a survival of 62.1 and 71.1 per cent, respectively. The rate of mortality was reduced to 17.8 per cent by a combined treatment of sulfanilamide and sulfamerazine.

Other observations were that sulfamerazine and sulfanilamide were well tolerated. Sulfaquinoxaline showed signs of toxicity during the second week of treatment. The period of mortality among the mice treated with a combination of sulfonamides in the second experiment was definitely shortened.

85. *Lymphocystis Disease and Ergasilid Parasites in Fishes.* Ross F. Nigrelli, New York Aquarium, New York Zoological Society.

Lymphocystis, a disease of fishes typically characterized by grayish nodular or flat growths in the skin and fins, has generally been considered of viral origin. It usually appears in the spring and progressively disappears during the summer. The growths contain so-called lymphocystis bodies, which are ovoid or spherical, measuring from ten microns to about one millimeter, and are regarded as enlarged fibroblastic or osteoblastic connective tissue cells. In the skin, they are usually found clustered in lymph spaces, surrounded by connective tissue and lymphocytes. Each lymphocystis body is surrounded by a thick hyalin capsule and may contain an enlarged nucleus and/or Feulgen-positive, basophilic elements. Recent studies on the black angel fish, striped bass, pumpkinseed and other fishes have shown that these structures are not only present in the skin, but also adhere to gill epithelium and occur within the gill-filaments, heart and other organs. Ergasilid parasites were also usually found on the gills, which were often hyperemic and ulcerated. A striking resemblance between the lymphocystis bodies and the eggs of these copepods was noted. The degree of parasitic infestation appeared to be correlated with the extent of the lymphocystis disease. Practically all fishes in which lymphocystis has been reported are known to be hosts for ergasilids or related copepods, and the known reproductive cycles of these crustaceans coincide with the appearance of the disease. The evidence points strongly toward copepods as the etiological agents involved.

86. *Some Pathogenic Effects of Gregarines on their Hosts.* G. H. Ball, University of California at Los Angeles.

It is the commonly-held opinion that the non-tissue-dwelling stages of eugregarines are not harmful to their hosts. This is based in part upon the fact that relatively few parasites are ordinarily present in a host as well as on the consideration that these forms do not multiply in the body of the host. In studying the gregarines of marine Crustacea, certain damaging effects on the host were observed which have not been previously described. These include the practically complete occlusion of small ducts such as the caeca of *Pachygrapsus marmoratus* by *Carcinoecetes conformis,* the destruction of epithelial cells by the effect of direct pressure as in *P. crassipes* by *C. hesperus,* and the undermining and sloughing of epithelial cells by the probing activities of protomerites in such forms as *C. bermudensis, C. mithraxi, C. calappae,* and *Nematopsis panopei.* This continual probing action of the trophozoite stages in various gregarines is aided by an apparent thigmotactic response which keeps the gregarines in contact with adjacent tissues and with one another after the undermining action has been initiated.

87. *Studies on the Transmission of* Toxoplasma gondii. Leon Jacobs, Paul A. Woke, and Frances E. Jones, National Institutes of Health, Public Health Service, Bethesda, Maryland.

Experimental work designed to test the various possibilities of transmission of *Toxoplasma gondii* has included attempts to transmit the infection by feeding dejecta or tissues from infected animals, and investigation of a number of arthropods as vectors.

Excreta of both acutely infected and asymptomatic rodents were collected and fed to mice, immediately or after storage. In no instance was infection produced in this manner. Eleven of 84 mice fed infected tissues died of toxoplasmosis. Of the remaining mice, which evidenced no disease following such feedings, 29 were tested by subinoculation; only 1 of these was found positive. The time of survival of mice which became infected varied from 11 to 14 days, similar to that of mice inoculated intraperitoneally with 10 toxoplasmas, indicating that the number of parasites which succeeded in penetrating the intestinal wall of mice fed infected tissues was a very low percentage of the numbers to be found in such tissues.

Arthropods which have thus far been tested as vectors of *T. gondii* include *Cimex lectularius, Xenopsylla cheopis, Ctenocephalides canis, Liponyssus bacoti, Psoroptes equi* var. *cuniculi, Culex quinquefasciatus, Rhipicephalus sanguineus, Amblyomma americanum, Triatoma phyllosoma, T. rubrofasciata, Rhodnius prolixus, Dermacentor andersoni, D. variabilis,* and *Pediculus humanis.*

No unequivocal evidence of transmission through the bite of these arthropods has yet been obtained. In tests on the last 5 named, however, toxoplasmas have apparently remained viable within the body of the arthropods for over 24 hours, in the case of *P. humanis* for 1 week, after engorgement on a donor host.

88. *Acid Phosphatase Staining Reactions in Intestinal Amoebae.* WILLIAM BALAMUTH, Northwestern University, Evanston, Ill.

A modified Gomori histochemical technique for demonstrating the presence of acid phosphatase has been applied to fixed smears of the following amoebae: *Entamoeba histolytica, E. coli, Dientamoeba fragilis,* and *Endolimax nana* from the human; and *Entamoeba terrapinae* from a terrapin.

All species of the genus *Entamoeba* have given strongly positive reactions, while the other genera have been consistently negative. The intensity of the reaction (measured by the amount of precipitate in the cytosome) varied directly with the incubation temperature of the substrate medium and the duration of exposure. Twenty-four hours' incubation at 30° C. produced a maximum effect, while shorter intervals gave more variable reactions, with an evident tendency for precipitation to begin in the vicinity of the nucleus. Variability was occasionally encountered in tests with *Entamoeba,* adjacent individuals in the same smear reacting differently at times and entire slides giving a negative reaction. It has not yet been determined to what extent this variability is due either to moribund individuals or to intrinsic variability in the method itself.

Controls were carried in each series, either by omission of glycerophosphate from the substrate medium or by addition of an inhibitor, sodium fluoride. The controls proved uniformly negative, although under certain conditions residual phosphate in the nucleus could be visualized.

The conclusion is reached that no correlation exists between presence of acid phosphatase and pathogenicity of intestinal amoebae.

89. *Experiments on Excystation and Growth of* Endamoeba histolytica *and* Endamoeba coli. CHARLES W. REES, National Institutes of Health, Public Health Service, Bethesda, Maryland.

The percentages of excystation of *Endamoeba histolytica* and *E. coli* derived from human stools were compared in microcultures in several kinds of medium. Both of the species excysted in the fluid of Anfinsen, Geiman, *et al.* without any associated microorganism, in the medium of Shaffer, Ryden, and Frye with a streptobacillus, and in the medium of Phillips with *Trypanosoma cruzi.* With cysts from different stools the figures on excystation ranged from 2 to 6 per cent without discernible differences between the two species of *Endamoeba.* When Cleveland's liver infusion agar was overlaid with each of the respective media the percentages of excystation were much higher. Cysts of *E. coli* from stools of 6 persons showed average figures ranging from 18 to 46 per cent excystation, with a maximum of 92 per cent. *E. histolytica* from stools of two persons gave figures of from 8 to 20 per cent excystation. The metacystic amoebae from *E. histolytica* cysts multiplied in the presence of *T. cruzi* with the production of up to 100 amoebae per cyst during 72 hours of incubation, but metacystic development did not occur in the presence of the streptobacillus. Amoebae hatching from *E. coli* cysts failed to multiply in any of the microcultures. However, following isolation of *E. coli* cysts in test tubes of whole egg medium with organism *t* and a species of *Geotrichium,* the cultivation of *E. coli* has been accomplished.

90. *Studies on Infections of a Caecal Worm,* Paraspidodera uncinata, *in Guinea Pigs.* W. D. LINDQUIST AND D. J. HITCHCOCK, Michigan State College.

An unusually large colony of guinea pigs of a local laboratory supplied us with 20 to 30 old discard pigs a week. Their colony was managed by the "table-top" method with litter composed of wood shavings. There were 358 animals autopsied yielding 2,101 worms, of which 978 were males and 1,081 females with 42 immature specimens. There was an average of 5.8 worms per animal, 225 being the largest single infection.

Infection experiments were attempted on 24 young guinea pigs raised in wire mesh cages in our own laboratory. Several fecal examinations by concentration methods were employed to determine the absence of nematode eggs before proceeding with infections although this worm has never been shown present in our laboratory raised stock. Embryonated eggs, varying from 4–35 days old, were fed orally by pipette. Seven animals were successfully infected, three of which never showed eggs in the feces, but upon autopsy more than 60 days later revealed one female worm each. The other 4 animals all showed eggs in the feces by concentration methods. Schwartz (1926) indicated the prepatent period of this species to be about 1 month. These 4 infections had prepatent periods of 64, 43, 42 and 37 days.

It appears that no one has reported data on the patent period for this nematode under conditions precluding reinfection. Three of the 4 established infections were followed by concentration egg counts until they remained negative for several days. The patent periods of these infections were 12, 29 and 39 days. Two of the three animals followed by fecal examinations

several days past their patent period had no worms at autopsy but the other one had retained 2 female worms. One guinea pig, killed before it became negative, had 43 nematodes in the caecum. All three guinea pigs, followed by egg count, appeared to have light infections and the highest egg count obtained was 17 eggs per approximate gram of feces. Fecal examinations of natural infections have yielded only small numbers of eggs and the same was true of these experimental infections.

91. *Oxygen Consumption Related to Oxygen Tension in* Rhabditis strongyloides *and other Nematodes.* Thomas D. Bair, Department of Biology, Utica College of Syracuse University, Utica, New York (Introduced by Lyell J. Thomas).

Employing a micro-Winkler method, the oxygen consumption of the nematodes, *Rhabditis strongyloides, Rhabditis sp.* and infective larvae of the small strongyles of the horse was determined. The worms were placed in small chambers in dilute saline and allowed to respire for a given length of time. A parallel blank analyzed with the samples from the chambers containing the worms made it possible to calculate the amount of oxygen consumed by a given number of worms in a given time. The oxygen tension of the saline was varied by bubbling oxygen or nitrogen through it. Curves were constructed in which oxygen consumption in mm^3 oxygen was plotted against cc oxygen per liter of saline. It was found that *Rhabditis strongyloides,* a semiparasitic form isolated by the author from pustules in the skin of a cow, had a critical tension of 2 cc of oxygen per liter. *Rhabditis sp.,* a free-living form from the soil, had a critical tension of 4 cc of oxygen per liter. The ensheathed small strongyle larvae showed no significant variation in oxygen consumption over a range of 1.5 cc to 13 cc of oxygen per liter. The oxygen consumption of the strongyle larvae was extremely small. A microburette for titrating the Winkler determinations is described.

92. *Deficiencies of Certain Minerals as Factors in Resistance of Chickens to Parasitism.* S. M. Gaafar, Fouad I University, Giza, Egypt and J. E. Ackert, Kansas State College, Manhattan.

Experiments were conducted on 476 young chickens to determine the importance of the phosphorus, calcium and manganese content of the feed as factors in the resistance of chickens to the parasite, *Ascaridia galli.*

Comparisons made between the numbers and lengths of *A. galli* from different groups of chickens parasitized with about 200 *A. galli* eggs per chicken showed significantly fewer and shorter worms from groups of fowls on a low phosphorus ration than from the control groups on adequate diets.

Results from groups of chickens on a low calcium diet also showed significantly fewer and smaller *A. galli* than from the control fowls kept on an adequate calcium ration.

The fewer and smaller *A. galli* from groups of fowls fed low phosphorus and low calcium rations are attributed to the worms' requirements for these minerals, since phosphorus and calcium are among the more important mineral constituents of ascarid parasites.

Manganese appears to have a minor, if not neutral, role in fowl ascarid parasitism. The host chickens also appeared to thrive normally without the addition of manganese sulfate to the ration. The lack of effect of manganese deficiency on the development of *A. galli* is attributed to the lack of manganese in the ascarid body.

93. Protostrongylus rufescens *in Domestic Sheep,* Ovis Aries, *in the United States.* Charles Durbin, Zoological Division, Bureau of Animal Industry, U. S. Department of Agriculture.

Members of the genus *Protostrongylus* have been reported as lungworm parasites of various wild ruminants and of hares and cottontail rabbits in the United States, but the first authenticated report of the occurrence of a member of this genus in domesticated sheep in the United States was made by Mapes and Baker (1949). The nematodes found by them in the lungs of domestic sheep at Ithaca, New York, were identified as *Protostrongylus rufescens* (Leuckart, 1865) Kamenskii, 1905 and a description of them was published by Dikmans and Mapes (1950).

While the above mentioned paper by Dikmans and Mapes was in press, the Zoological Division received from Dr. Ralph Honess, University of Wyoming, some lungworms collected from domestic sheep in that state. On examination these proved to be *Protostrongylus rufescens.*

The writer recently necropsied two sheep at Gordonsville, Virginia. The lungs of both of these sheep were found to be heavily infested with *P. rufescens* and *Muellerius minutissimus.*

At the present time, therefore, *Protostrongylus rufescens* has been found in domestic sheep in three widely separated areas in the United States, namely, New York, Wyoming and Virginia.

In view of the great distance between the areas of these reports it seems probable that *P. rufescens* is more widely distributed in domestic sheep than is indicated by the published reports.

94. *An Improved Method for the Complete Elimination of Microorganisms from* Ascaris lumbricoides. DONALD FAIRBAIRN, The Institute of Parasitology, Macdonald College, P. Q., Canada.

Fairbairn and Reesal (*Science,* in press) described a method for the complete elimination of microorganisms from *Ascaris lumbricoides.* Microorganisms could not be demonstrated in 85 per cent of worms treated individually and anaerobically with a mixture of acriflavine, sulphathiazole, azochloramide streptomycin and penicillin dissolved in nutrient broth. Subsequent investigations, in which a nutrient medium more adequate for survival of *Ascaris* was used, showed clearly that the intestinal canal of some of these apparently axenic worms harboured bacteria which were not detected in the medium for a week or more following treatment. The original method has now been modified in such a way that 80–90 per cent of *Ascaris* individuals appear to be free of microorganisms during the life of the worms (that is, two weeks) in the improved medium.

The principal changes which have been made in the eight-hour treatment period are (1) the omission of sulphathiazole, which was found to form a relatively inactive complex with acriflavine, and (2) the substitution of glucose for the sodium chloride required to make the solution isotonic. Other, minor alterations in technique will be described in detail.

It is probable that a clearcut demonstration of complete freedom from microorganisms cannot be made until a nutrient medium is developed in which *Ascaris* will survive for a period of some weeks. Individuals, apparently axenic, are being used for short-term investigations of nutrition and metabolism, and should simplify the discovery of more suitable media.

95. *Observations on the Path of Larvae of* Strongyloides agoutii *in the Guinea Pig and the Effectiveness of the Method of Inoculation.* MICHAEL R. REESAL, Institute of Parasitology, Macdonald College, P. Q., Canada.

Strongyloides agoutii, is a parasite of the South American rodent, the agouti, which can be transmitted to the guinea-pig. Percutaneous infection results in 12 to 16 per cent of the larvae reaching maturity whereas oral infection results in 6 per cent and direct stomach infection in 0.2 per cent; if the larvae are placed on the buccal mucosa of an anaesthetized guinea-pig, however, 22 per cent reach maturity. After tracheotomy, no larvae placed in the stomach reached maturity although some reached the heart and lungs. Artificial gastric juice was not quickly lethal to the larvae and it is concluded that migration is a biological necessity for *Strongyloides* no matter how larvae are introduced into the body.

96. *The Effect of Oral DDD (TDE) on Natural Resistance of Mice to Infection with* Trichinella spiralis. CHARLES BAUGHN, University of North Carolina.

It is reported that the compound DDD given orally to dogs and rats is stored in various tissues of the body. In dogs severe adrenal cortical atrophy results, but this has not yet been shown in experiments with rats, rabbits, monkeys and mice. The present experiment with mice was conducted to test the effect of this compound on natural resistance to the adult stage of *T. spiralis.*

Three equal groups of mice, all five weeks of age, were used. Preliminary experiments established the dose of DDD. The 6 mice of group 1 received orally 0.1 cc. of a 1 : 10 solution of DDD in corn oil which was given each day for three weeks. Group 2 mice received 0.1 cc. of corn oil only, while the group 3 mice were not treated. After three weeks each mouse was infected with 300 *T. spiralis* larvae. The mice were autopsied on the seventh day following infection and counts made of the adult *T. spiralis* recovered from the small intestine.

The number of worms from the mice of group 1 (average, 182.3) and group 3 (average, 191.8) was not significantly different as shown by statistical analysis, whereas the number from the group 2 mice (average, 141.9) was significantly lower than that of the other groups.

It is concluded that DDD in corn oil as given in this experiment had no demonstrable effect on natural resistance. On the other hand, corn oil alone for unexplained reasons reduced the number of adult worms found seven days post-infection. Experiments are in progress to check these results and to test, after longer treatments, the effect of DDD both on the number of adults in the intestine and larvae in the musculature.

97. *The Effect of Body Weight on the Natural Resistance of Mice to* Trichinella spiralis. JAMES R. HENDRICKS, University of North Carolina.

It is reported that mice allowed to nurse rat mothers grow faster than mice nursing mouse mothers, presumably because of the greater quantity of milk received. This suggested a means of testing the effect of body weight *per se* on resistance to *T. spiralis.*

Three litters of mice born on the same day were divided equally into two groups of 12 each. The mice of group 1 were left with two mouse mothers, those of group 2 were placed with one rat mother whose litter of the same age was discarded (the three mothers had not been infected

with *T. spiralis*). At 13 days the average weight of the mice of group 1 (5.8 grams) compared favorably with records of the stock colony, while the group 2 mice averaged 2.5 grams heavier. At 26 days the weight averages for groups 1 and 2 were 11.4 and 17.8 grams, respectively, or a difference of 6.4 grams. After weaning at 28 days this average difference became progressively less until the time of infection at seven weeks when it was 4.6 grams. Each mouse was infected with 100 *T. spiralis* larvae. Seven days later counts were made of adult worms in the small intestine.

As shown by statistical analysis, the average number of worms from the mice of group 1 (65.4) was significantly greater than that from the group 2 mice (54.9).

Since these mice were litter mates, the results show that body weight *per se* was involved in the increased natural resistance of the mice that nursed the rat. Experiments are planned to check these results and to determine, if possible, whether factors other than the quantity of milk are involved.

98. *Studies on the Life Cycle of* Physaloptera rara *Hall and Wigdor, 1918, and* Physaloptera praeputialis *Linstow, 1889.* L. H. Petri; D. J. Ameel, Kansas State College.

The life cycle of *Physaloptera rara* Hall and Wigdor 1918, has been completed using the German cockroach, *Blatella germanica,* as the intermediate host. Third stage larvae were recovered from cysts attached to the hind-gut region of the cockroaches 21 days after exposure to embryonated eggs. Each of three laboratory born and reared kittens was fed five cockroaches which had been exposed to embryonated eggs of *P. rara.* The first kitten was examined 30 days after feeding, and 48 immature *Physaloptera* ranging in length from 3–9 mm. were recovered from the stomach. The second kitten was examined 56 days after feeding and 31 immature *Physaloptera* ranging in length from 5–27 mm. were recovered. The third kitten was killed 83 days after exposure, and 78 worms ranging from 8–39 mm. in length were recovered from the stomach and anterior portion of the duodenum. Many of the females of this latter group of worms were sexually mature and deposited embryonated eggs when placed in 0.8 per cent saline.

Using the same intermediate host, the life cycle of *P. rara* has been successfully completed with the dog and coyote as the final host.

Third stage larvae of *P. rara* have been recovered from experimentally exposed field crickets, *Gryllus assimilis,* flour beetles, *Tribolium confusum,* and ground beetles, *Harpalus sp.*

Third stage larvae of *Physaloptera praeputialis* also have been recovered from experimentally exposed German cockroaches, *Blatella germanica,* camel crickets, *Centophilus sp.,* and common field crickets, *Gryllus assimilis.*

99. *Parasites of the Brevicipitidae (Amphibia).* A. C. Walton, Knox College.

The annotated catalog of the parasites of the family *Brevicipitidae* indicates the list of hosts and their parasites as follows:—1. *Cacopus systoma* (Burma)—*Amplicaecum cacopi* (Nematoda); and *Opalina japonica* (Protozoa). 2. *Gastrophryne areolata* (U.S.A.)—*Cosmocercoides dukae* (Nematoda). 3. *Gastrophryne carolinensis* (U.S.A.)—*Cosmocercoides dukae, Rhabdias ranae,* and *Spironoura catesbianae* (Nematoda; and *Opalina obtrigonoidea,* and *O. ?triangularis* (Protozoa). 4. *Gastrophryne texensis* (U.S.A.)—*Protoopalina ovoidea,* and *Trichomonas augusta* (Protozoa). 5. *Gastrophryne usta* (Mexico)—*Protoopalina xyster* (Protozoa). 6. *Hypopachus muelleri* (Brazil)—*Aplectana* sp? Travassos, et al., 1939 (Nematoda). 7. *Hypopachus variolosus* (Cent. Amer.)—*Zelleriella hypopacheos* (Protozoa). 8. *Kaloula borealis* (China)—*Opalina acuminata, O. cheni,* and *O. obtrigonoidea lata* (Protozoa). 9. *Kaloula picta* (Philippines)—*Protoopalina luzonensis* (Protozoa). 10. *Kaloula pulchra* (China)—*Oswaldocruzia hoepplii* (Nematoda); (in tadpoles and adults) larval *Pharyngostomum cordatum* (Trematoda); larval *Echinorhynchus* sp? Shipley, 1903 (Acanthocephala); and *Cepedea pulchra* (Protozoa). 11. *Microhyla carolinensis* (U.S.A.)—*Aplectana hamatospicula, A.* sp? Walton, 1940, and *Cosmocercoides dukae* (Nematoda). 12. *Microhyla inornata* (S. E. Asia)—*Kiricephalus pattoni* (Pentastomida). 13. *Microhyla leucostigma* (Borneo)—*Cepedea microhylae* (Protozoa). 14. *Microhyla ornata* (Burma, China, India)—(in tadpoles and adults) larval *Pharyngostomum cordatum* (Trematoda); and *Nyctotherus* sp? Metcalf, 1923, *Opalina ?malaysiae, Protoopalina caudata microhylae,* and *Zelleriella orientalis* (Protozoa). 15. *Microhyla pulchra* (China, Fr. Indo-China)—(in tadpoles and adults) larval *Pharyngostomum cordatum* (Trematoda); and *Trypanosoma* sp? Laveran & Mesnil, 1912, and *T.* sp? Mathis & Leger, 1911 (Protozoa). 16. *Microhyla sowerbyi* (China)—larval *Diphyllobothrium erinacei* (Cestoda). 17. *Phrynomantis bifasciata* (Africa)—*Cepedea phrynomantidis* (Protozoa).

100. *Parasites of the Amphibia. Nematoda. I.* A. C. Walton, Knox College.

The following hosts and/or Nematode parasites have been added to the catalog since earlier

publication:—1. *Amphiuma tridactylum* (U.S.A.)—larval *Eustrongylides ignotus.* 2. *Boulengerula taitanus* (Africa)—*Oxyuris* sp? Loveridge, 1936. 3. *Bufo arenarum* (Argentina)—*Borellostrongylus platensis, Oxysomatium bonariensis,* and *Rhabdias elegans.* 4. *Bufo d'orbignyi* (Argentina)—*Oxysomatium bonariensis.* 5. *Bufo marinus* (Argentina)—*Oswaldocruzia mazzai.* 6. *Bufo marinus* (Fr. Guiana)—*Foleyella vellardi.* 7. *Bufo marinus* (Guatemala)—*Foleyella brachyoptera,* and *Ochoterenella digiticauda.* 8. *Bufo paracnemis* (Paraguay)—*Ochoterenella digiticauda Oswaldocruzia mazzai, Physaloptera venancioi,* and *Spironoura mascula.* 9. "Bull Frog" (Japan)—*Spinicauda japonica.* 10. *Desmognathus fuscus* (U.S.A.)—*Oswardocruzia pipiens.* 11. *Eurycea bislineata* (U.S.A.)—Spirurid cysts of Rankin, 1945. 12. *Eurycea bislineata wilderae* (U.S.A.)—*"Oxyuris" magnavulvaris.* 13. *Eurycea longicauda gutto-lineata* (U.S.A.)—*Oswaldocruzia* sp? Rankin, 1937. 14. "Frogs" (Africa)—*Amphibiophilus acanthocirratus, Amplicaecum involutum, Angusticaecum numidicum, Camallanus multiruga, Foleyella duboisi, Oswaldocruzia* sp? Walton, 1935, larval *Physocephalus sexalatus,* and *"Spiroptera" stylosa.* 15. "Frogs" (Europe)—*Aeleurostrongylus abstrusus* (exp.), *Aplectana acuminata, Cosmocerca ornata, Filaria* spp? Blanchard, 1887, Leuckart, 1876, and v. Linstow, 1899, *Oxysomatium brevicaudatum,* and *Rhabdias bufonis.* 16. "Frogs" (E. Indies)—*"Spiroptera" furcata.* 17. "Frogs" (India)—*Camallanus* sp? Mirza and Basir, 1938. 18. "Frogs" (Philippines)—*Oxysomatium ranae.* 19. "Frogs" (U.S.A.)—*Aeleurostrongylus abstrusus* (exp.), larval *Physocephalus sexalatus, Rhabdias ranae, Spiroxys contortus,* and Spirurid larvae of Cram, 1924. 20. *Hoplophryne rogersi* (Africa)—*Mermis* sp? Baylis, 1929 (pseudoparasite).

101. *Parasites of the Amphibia. Nematoda. II.* A. C. Walton, Knox College.

21. *Leptodactylus bufonius* (Paraguay)—*Oswaldocruzia mazzai.* 22. *Leptodactylus ocellatus* (Paraguay)—*Oswaldocruzia mazzai,* and *Spironoura mascula.* 23. *Megalobatrachus japonicus* (Japan)—*Megalobatrachonema nipponicum.* 24. *Nectophrynoides vivipara* (Africa)—*Oxysomatium macintoshii.* 25. *Pipa pipa* (Zool. Gard., U.S.A.)—*Eustrongylides* sp? Ratcliffe, 1934. 26. *Plethedon cinereus* (U.S.A.)—*Cosmocercoides dukae,* and *Oswaldocruzia pipiens.* 27. *Polypedates maculatus* (Ceylon)—*Amphibiophilus acanthocirratus.* 28. *Probreviceps macrodactylus* (Africa)—*Amplicaecum involutum.* 29. *Pseudosalamandra hida* (Japan)—*Pharyngodon* sp? Wilkie, 1930 (♀ only). 30. *Rhyacesiredon altimirani* (Mexico)—*Spironoura cryptobranchi* (♂♂ & ♀♀). 31. "Tadpoles" (U.S.A.)—*Dracunculus ophidensis* (2nd stage larvae). 32. *Triturus meridionalis* (U.S.A.)—*Hedruris chandleri.* 33. *Triturus torosus* (U.S.A.)—*Hedruris chandleri.* 34. Miscellaneous parasites:—a. "Frogs"—*Bacillus adhaerans, B. krusei, B. panis, B. tumescens, Borrelia bufonis, Escherichia coli, Mycobacterium marinum* (exp.), *M. piscium* (exp.), *M. thamnopheos* (exp.), *M.* sp? Gonzalez, 1938 (exp.), *Proteus hydrophilus, Salmonella ranicida,* and *Vibrio piscium* (exp.) (Bacteria). b. "Frogs" (China)—*Batrachobdella singularis* (Hirudinea). c. "Frogs" (Europe)—*Monilia (Candida) batrachea* (Fungi), *Glossiphonia swampina,* and *Protoclepsis occidentalis* (Hirudinea), and *Forcipomyia velox* (Diptera). d. "Frogs" (U.S.A.)—(in tadpoles and adults) *Haementeria montifera,* and *Macrobdella decora* (Hirudinea). e. *Hyla squirrela* (U.S.A.)—larval mite *(Eutrombicula splendens = E. mansoni = Acariscus mansoni).* f. *Phrynomerus microps* (Africa)—*Nais bauchiensis* (pseudoparasitic Oligochaeta).

102. *Studies on Experimental Chagas' Disease in Mice in Relation to Chemotherapeutic Testing.* Frans C. Goble, Sterling Winthrop Research Institute.

The empirical approach to the discovery of new compounds active against *Trypanosoma cruzi* necessitates extensive *in vivo* screening. Experimental Chagas' disease in mice is commonly used in such work, but little detailed information on the use of this infection in chemotherapeutic testing has been published. In the present work the use of cultural forms as inocula has given satisfactory results over a period of four years.

When 3-week-old mice (Webster) were infected by intraperitoneal injection of 30 million cultural forms of *T. cruzi* ("Brazil" strain), deaths sometimes took place as early as the 10th day after infection. Commencing medication 4 days after infection allowed 6 consecutive daily doses of test compounds to be given before the onset of mortality. Estimates of drug activity were based on comparative survival times.

Another strain of *T. cruzi* (designated "A") was initially found to be slightly more pathogenic than "B" ("Brazil") in both A-mice and Webster mice inoculated with cultural forms. After one year in culture, however, maintained under conditions identical to those for "B," this "A" strain underwent diminution of virulence. A-mice were found to be more susceptible than Webster to both "A" and "B" strains of *T. cruzi.* Males were slightly more susceptible than females.

103. *The Respiration of Trypanosome-infected Rats.* Theodor von Brand, National Institutes of Health, Public Health Service, Bethesda, Maryland.

The available data on the influence of trypanosome infections on the respiration of the hosts are contradictory and based on small numbers of experiments. Since they have nevertheless been used as a basis for speculation on the nature of the damage produced by the parasites, a reinvestigation on a broader basis was undertaken.

A total of 90 rats have so far been used, divided into the following groups:

1. Rats infected with *Trypanosoma equiperdum,* fasted for 16 hours before the determinations
2. Rats infected with *Trypanosoma equiperdum,* not fasted
3. Rats infected with *Trypanosoma evansi,* not fasted

The 3 groups gave identical results. No change in oxygen consumption was found until about 36 hours before death. In the last 24 to 36 hours before death, an increase in oxygen uptake averaging 10 to 20 per cent was observed. This is greater than could be expected as resulting from the slight increase in body temperature occurring at this stage of the infection. It must hence be assumed that the increase is due in part to the oxygen consumption of the parasites. It is, however, so slight that it does not lend support to theories based on the assumption that asphyxiation is involved in the pathogenesis of trypanosomiasis.

104. *Carbohydrate Metabolism in Chickens Infected with* Eimeria tenella. Jack W. Daugherty, University of Wisconsin.

Chickens infected with the cecal coccidia, *Eimeria tenella,* have been shown to exhibit certain physiological manifestations, e.g., high blood sugar level, low muscle glycogen, impaired coordination, and muscle asthenia, among others. A series of experiments were planned to test the hypothesis that some, if not all, of these physiological changes were brought on by disturbances in the intermediary metabolism of carbohydrates in the chicken.

Homogenates taken from the ceca of infected chickens were found to possess marked inhibitory power with regard to the glycolytic capacity of chicken brain tissue in vitro. The degradation of fructose-1,6-diphosphate by brain under the same conditions was not affected. The cecal material, therefore, presumably inhibited the phosphorylation steps in the glycolytic metabolism of glucose. Further evidence of this was obtained with the demonstration that inorganic phosphate esterification was reduced in the presence of the material from infected ceca. Homogenates from normal ceca possessed no inhibitory activity. R. Q.'s of uninfected muscle slices assumed an average value of .86 whereas the R. Q.'s of infected muscle slices were .73. These findings are suggestive of an involvement of carbohydrate metabolism and will be discussed elsewhere in detail in their relation to the physiology of the chicken during a severe infection with cecal coccidia.

105. *The Effect of Cecal Coccidiosis on the Metabolic Rate of Chickens.* C. A. Herrick, University of Wisconsin.

The metabolic rate of chickens infected with cecal coccidia and corresponding uninfected, control chickens was determined daily prior to and following infection. When the environmental temperature equaled the critical temperature of the chickens the coccidia had only a slight depressing effect. When the environmental temperature was decreased, the metabolic rate of the infected chickens was correspondingly reduced. Under the same environmental conditions, however, the metabolic rate of the uninfected chickens was increased.

106. *Some Relationships Between the Respiratory Rate of Cecal Mucosa and Resistance of Chickens to Cecal Coccidiosis.* C. A. Johnson and C. A. Herrick, University of Wisconsin.

The respiratory rate of cecal mucosa taken from the proximal, distal and medial portions of the ceca of normal chickens was found to be significantly different. Following severe or repeated infections, the respiratory rate of the medial and distal regions of the ceca was reduced and approached that of the proximal region where infection was at a minimum. When determinations of the respiratory rate of the cecal mucosa of infected chickens were made at regular intervals following infections it was found that the respiratory rate of the damaged or regenerated mucosa gradually increased and eventually returned to its previous level. When the respiratory rate of the cecal mucosa of previously infected chickens had returned to the preinfection level the chickens were still highly resistant to infection.

107. *Coccidiosis of the Turkey.* Philip A. Hawkins, Michigan State College.

Coccidiosis in turkeys has been demonstrated to be caused by at least four species of coccidia. These are *Eimeria meleagridis, E. meleagrimitis, E. dispersa* and *E. gallopavonis.* Of these four *E. gallopavonis* has been described as a new species, and *E. dispersa* originally described from the bob-white quail and pheasant has been shown to occur commonly in the turkey in most sections of the United States. In addition, infection with the latter species was estab-

lished in the Hungarian partridge. From experimental studies and from field reports it seems apparent that *E. meleagrimitis* is the only species which is capable of producing serious loss in the turkey. In the case of two to three week old turkey poults it was possible to produce a 100 per cent mortality. However, it was not possible to produce any mortality, and only mild symptoms with the same infecting dose in four month old turkeys. Field reports indicate that clinical cases of coccidiosis are rarely observed in turkeys over eight weeks of age. This disease in the turkey is not characterized by hemorrhage, which is so frequently present in coccidiosis in other species of birds and mammals. The microscopic lesions of poults infected with this species were those of necrosis and sloughing of the epithelium.

The developmental forms, lesions, symptoms and immunity produced against the above four species will be discussed.

108. *The Effect of Nitrofurazone on Normal and Coccidiosis Infected Turkeys.* Earl N. Moore and J. A. Brown, New York State Veterinary College, Ithaca, N. Y.

Forty-two normal turkeys ranging in weight from 416 grams to 13,770 grams were divided into 1 to 7 groups containing 5, 5, 6, 8, 8, 8, and 2 birds, respectively. Birds of various ages in each group received a single dose of nitrofurazone in a capsule at drug levels of 200, 175, 150, 125, 100, 75, and 50 mgm/kilogram of body weight, respectively.

Symptoms of intoxication appeared under 24 hours and persisted for three days. These consisted of depression, ruffled feathers, incoordination, spasmodic head and body movements, and exhaustion. Deaths occurred from one to five days after dosing. The mortality by groups was as follows: four birds (80%) in group 1; one bird (20%) in group 2; five birds (80%) in group 3; five birds (62.5%) in group 4; three birds (37.5%) in group 5; one bird (12.5%) in group 6; and none in group 7. No gross pathology was observed. Histopathological studies are in progress.

Nine poults averaging 1,079 grams in weight were fed nitrofurazone at approximately the therapeutic level recommended for chickens of 1 to 9,600 (0.0104%) continuously for 35 days. They gained 227 grams less than did nine control poults, averaging 1,234 grams, on unmedicated feed. This difference is not statistically significant, by the t-test, when corrected for difference in starting weight between the two groups.

Each of 14 coccidia-free, five-week old poults was dosed with a uniform suspension of sporulated oocysts (turkey origin and species unknown) on two successive days. An all-mash ration containing nitrofurazone in a drug-feed ratio of 1 to 9600 (0.0104%) was fed continuously for 14 days starting 48 hours after dosing. A control group received a similar infection, but without medication. Fifty per cent of the controls died of coccidiosis, whereas none of the treated birds died although visible illness was evident and oocysts were passed. When this experiment was repeated with 17 experimental and 16 control poults, with the difference that the inoculum was distributed over a three day period, 93.8% of the controls died. There was no mortality in the treated group.

109. *The Genus* Corallobothrium *from Catfishes in Lake Texoma, Oklahoma, with a Description of Two New Species.* Kermit E. Sneed, University of Oklahoma and Oklahoma Fisheries Research Laboratory, Norman, Oklahoma.

Two new species of the genus *Corallobothrium* have been described. Three worms, designated as *Corallobothrium procerum* sp. nov. were taken from *Ictalurus furcatus,* the blue catfish. This new species is characterized by possessing testes arranged in one layer and often in two fields. The number of testes present varies from 225 to 268; these measure from 75 to 120 mu in diameter. This is more than double the number and double the size of the testes in *C. giganteum,* a closely related species. The vas deferens contains 10 to 18 coils, which extend from the midline to the cirrus pouch. The length of the pouch is one-fifth to one-fourth the breadth of the proglottid. Vasa efferentia are visible. The ductus ejaculatoris is coiled. The compact ovary has both anterior and posterior margins rounded. The muscular system is weakly developed and the excretory system is only faintly visible.

A new species from *Ictalurus lacustris,* the Southern channel catfish, is designated as *Corallobothrium thompsoni* sp. nov. It differs from *C. procerum* in possessing a consistently lower number of testes, a straight ductus ejaculatoris, a well-developed muscular and excretory system. The length of the cirrus-pouch is one-ninth the breadth of the proglottid, as compared to one-fifth to one-fourth for *C. procerum.*

Both species exhibited atypical development. The proglottids became longer than broad, but the genital organs were not mature in many worms 30 cm. long.

110. *Parasites of 17 Species of Sharks from the Gulf of Mexico.* Aaron Seamster, Del Mar College; Jack Baughman, Texas Game, Fish and Oyster Commission.

Information is presented concerning the types of parasites that have been described from 17 species of sharks taken in the Gulf of Mexico. Literature studies indicate that the hammerhead shark, *Sphyrna zygaena* is the host for the greatest number (34) species of parasites. Fourteen species of cestodes, fourteen of copepods, four nematodes, and two trematodes have been reported from this host.

111. *Experiments on the Nutrition and Host Relations of* Hymenolepis diminuta *in White Rats, with Special Reference to Vitamins and Hormones.* J. Walter Beck and Asa C. Chandler, Rice Institute.

A diet containing starch is more favorable for tapeworm growth than one containing sucrose or dextrose as the sole carbohydrate. Complete elimination of thiamin from the diet has no ill effect on tapeworms. Experiments using parenterally injected radioactive thiamin showed that the worms can obtain their thiamin directly from the host.

Studies with single-worm infections showed that in male rats a higher level of egg production is reached than in females, and in a much shorter time. Once a stable high level is reached, it is maintained for at least 5 months. A diet lacking yeast, although fortified with the known B-complex vitamins, greatly lowers egg production in male as well as in female rats, but more slowly. In male rats, however, there is little or no diminution in size, whereas in female hosts the worms become markedly shorter. Castration of male hosts affects egg production as does lack of yeast. Testosterone injections stimulate egg production after it has been inhibited by either castration in male hosts or deficient diet in female hosts. Progesterone has a similar effect in castrated males but not in normal females on deficient diet. Injections of gonadotropic hormones stimulate egg production in either sex after inhibition by lack of yeast. B_{12} had no such effect. Male dog bile stimulates egg production in both sexes after inhibition by deficient diet, but the effect is sustained only in male hosts.

112. *Ecological Relationships of Tapeworms (Diphyllobothriidae) to the Infection of Fish and Fish-eating Birds of the Great Lakes Region.* Lyell J. Thomas, University of Illinois and the University of Michigan Biological Station.

In the Great Lakes Region the heavy production of *Diphyllobothrium,* tapeworms, in fish and fish-eating birds is dependent upon the following factors: size of the bird rookeries, suitable shoals for the spawning of susceptible fish and the development of mayfly and caddice fly emergents and copepods, size and availability of susceptible fish as food for the birds, the shedding of tapeworms by young birds, water temperature, and water currents, all in close proximity to the rookeries.

Large rookeries in the Beaver Island archipelago and the entrance to Green Bay, Lake Michigan meet all of these requirements. In Lake Nipissing, the Goose Island rookeries are too small and too far from the spawning grounds for the infection of fish and birds in significant numbers.

113. *Some Anomalies Observed in Developmental Stages of the Diphyllobothriidae.* Dominic L. De Giusti, Wayne University.

A coracidium having 12 hooklets was hatched from the egg of *Diphyllobothrium sp.* found in the intestine of the Herring Gull *(Larus argentatus).*

A plerocercoid of *Diphyllobothrium sp.* taken from a stomach wall cyst in the Cisco *(Leucichthys artedi)* was found to have in addition to the normal scolex, three scolices budding off from the posterior portion of the plerocercoid body.

A procercoid of *Schistocephalus sp.* having a double body and two cercomeres has been recovered from experimentally infected *Cyclops.*

114. *A Comparative Study of the Coracidia and Procercoids of Pseudophyllideans of the Great Lakes Region.* Kathleen L. Hussey, Columbia University.

Data is presented on the activity and structure of the coracidia of *Haplobothrium globuliforme, Schistocephalus solidus, Diphyllobothrium oblongatum, Diphyllobothrium* sp. (undescribed species) and *Diphyllobothrium latum,* and of the procercoids of *Schistocephalus* and *Diphyllobothrium.*

Very little difference is noted between the 3 species of *Diphyllobothrium* studied. From these preliminary studies, it appears to be possible to differentiate the coracidium of *Schistocephalus* from that of *Diphyllobothrium* by its more rapid and "directional" swimming, the greater average number of "plastinzellen" and the greater length and coiling of the excretory tubes.

Procercoids of *Schistocephalus* appear to be more active in the hemocoel of the crustacean, and to develop more rapidly than do those of *Diphyllobothrium.*

115. *Effects of a Pure Infection of the Tapeworm* Moniezia expansa, *on Lambs.* M. F. Hansen, Kansas State College; A. C. Todd, Kentucky Agricultural Experiment Station; and G. W. Kelley, University of Nebraska.

Studies on the effects of pure infections of *Moniezia expansa* were conducted on 6 parasite free lambs during 1948 and 1949 at the Department of Animal Pathology, University of Kentucky. There were consistent and statistically significant differences between the weekly gain in weight of the lambs infected with *M. expansa* and uninfected control lambs. Retardation in rate of gain in weight of infected lambs began with maturity of the tapeworms and became most pronounced when the lambs spontaneously expelled their tapeworms.

A depression of the hemoglobin content of the blood occurred in the infected lambs. This reduction in hemoglobin was considered to border on anemia. No appreciable changes were noted in the white blood cell counts.

The number of *M. expansa* in an initial infection in a lamb may influence the resistance of a lamb to reinfection with this tapeworm. A lamb which developed tapeworms from an initial exposure to 80 cysticercoids of *M. expansa* resisted a challenge exposure of 13 cysticercoids, 119 days subsequent to expelling its initial tapeworm infection. This lamb was still refractory to tapeworm infection when challenged again with 3 cysticercoids 3 months later. A second lamb which developed tapeworms from an initial exposure to 20 cysticercoids of *M. expansa* was reinfected successfully when exposed to 5 cysticercoids, 119 days subsequent to expelling its initial tapeworm infection.

116. *The Embryonic Hooks of some Anoplocephalid Cestodes of Mammals.* K. C. Kates and Allen McIntosh, Zoological Division, Bureau of Animal Industry, U. S. Department of Agriculture.

In life history studies of anoplocephalid cestodes, some means is needed for recognizing and distinguishing between the various species when found in the intermediate host. Freeman (1949), working on porcupine cestodes of the genus *Monoecocestus,* stated that cysticercoids in oribatid mites could be identified on the morphology of the embryonic hooks. With this lead, drawings and measurements of onchosphere hooks of a few selected anoplocephalid species were made for comparison. In our study we find: *Anoplocephala magna* (horse) has stout hooks, all similar, 9.5 microns long, with slightly expanded well-developed guards 1 micron long; *Monoecocestus americanus* has slender hooks, all similar, 10.5 microns long, with well-developed guards 1 micron long; *Moniezia expansa* (sheep) has slender hooks, all similar, 9 microns long, with short guards 0.6 microns long; *M. benedeni* as *M. expansa; Thysanosoma actinioides* (sheep) has 2 pairs short hooks 7.1 microns long, and 1 pair long hooks 9.2 microns long, all hooks without guards; *Wyominia tetoni* (bighorn sheep) has 2 pairs short hooks 9.2 microns long, with guards 0.4–0.5 microns long, and 1 pair long hooks 12.4 microns long without distinct guards. The disparity in morphology on the onchosphere hooks of the species studied, especially the dissimilarity found in the pairs of hooks in *Thysanosoma* and *Wyominia,* leads us to believe that this should prove a practical tool for the identification of cysticercoids encountered in intermediate hosts and that on study of the embryonic hooks of a greater variety of species their morphology may prove indicative of phylogenetic relationships.

117. *The Pathologic Changes Associated with* Thysanosoma actinioides. Rex W. Allen and Patricia M. Kyles, U. S. Bureau of Animal Industry.

Pathologic changes associated with the adult stages of cestodes are not frequently encountered. It is of interest, therefore, to point out the common occurrence of such changes in sheep harboring *Thysanosoma actinioides,* a parasite which occurs in the biliary ducts and duodenum. It is in the former location that the marked changes occur and these are found principally in the common duct.

The tapeworms may occlude the ducts, and usually there is dilatation and thickening of the common duct. Within, the bile may be turbid and the duct wall inflamed and hyperemic. A study of the histopathology in specimens of the common bile duct from 19 infected sheep showed that there was a fibrosis of the duct wall in 100 per cent of the cases, a proliferation of ducts and hyperplasia of the epithelium in 84 per cent, cellular infiltration involving mainly lymphocytes in 79 per cent, and necrosis in 37 per cent. Bacterial invasion had occurred in the tissues. The question of whether *Thysanosoma actinioides* is the primary or secondary cause of these pathologic changes has not been determined.

118. *The Effects of a Protein-Deficient Diet on Resistance of Mice to* Hymenolepis *Infection.* John E. Larsh, Jr., University of North Carolina.

Little work has been reported on the effects of protein on resistance to infectious agents

and none was found dealing with *H. nana*. The two preliminary experiments reported here have to do with the effects of protein both on natural and acquired resistance to *H. nana* var. *fraterna*.

In experiment 1 on natural resistance, litter mates, 2.5 months old were divided into 2 groups of 7 each. Those of group 1 were placed on the protein-deficient diet (Donaldson and Otto, Amer. J. Hyg., *44*, 384–400), those of group 2 were continued on a balanced diet. After 3 weeks, the mice were infected with 1,000 eggs, and 93 hours later counts were made of the number of cysticercoids observed. In experiment 2 on acquired resistance, the same procedure was followed through the initial infection, then the 6 mice of each group were kept on their respective diets for one week and given a second infection of 1,000 eggs. Counts of cysticercoids were made 93 hours later. The data of both experiments were analyzed statistically.

In experiment 1, the mice on the deficient-diet harbored significantly more cysticercoids than controls (63.5 and 34.8, respectively). In experiment 2, the mice on the deficient diet had an average of 7 cysticercoids while the controls had none.

These results showing a reduction in natural resistance (experiment 1) and interference with the development of acquired resistance (experiment 2) agree with those of Donaldson and Otto for rats infected with *Nippostrongylus muris*. Experiments are planned to check the above results by using diets formulated particularly for mice, and to study the mechanism by which such results are brought about.

119. *Length of the Pupal Period of* Cuterebra buccata *(F.)* F. D. Enzie and Allen McIntosh, Zoological Division, Bureau of Animal Industry, U. S. Department of Agriculture.

On July 29, 1948, a mature *Cuterebra* larva from a freshly killed cotton-tail rabbit, *Sylvilagus floridanus mallurus* (Thomas, 1898) was placed in a beaker of moist sand and kept in the laboratory at room temperature at Beltsville, Maryland; small amounts of water were occasionally added to the beaker to keep the sand moist. Thirty-four days later an adult female fly emerged. Again on August 1, 1950, 2 mature larvae from a freshly sacrificed specimen of the same host were placed in a beaker of moist sand and kept under similar conditions. On September 2, a male and a female specimen of *Cuterebra buccata* emerged, 32 days being required for the pupal period. The shortness of the pupal period and the fact that the adult fly has been taken in this locality early in the spring indicates that there are at least two broods a year in the region of Beltsville, Maryland. It was surprising to the writers that the time of emergence was so short in view of the report of Knipling and Brody (J. P., 1940) who found, in their work on cuterebrine larvae at Valdosa, Georgia, that 75 days were required for the pupal period of a mature larva of the same species collected from a cotton-tail in the month of June.

120. Thelohania cambari *n. sp., a Microsporidian Parasite of North American Crayfish.* Victor Sprague, Lake Chatuge Biological Laboratory.

A hitherto undescribed species of *Thelohania* occurs in the muscular tissues of *Cambarus bartoni* inhabiting the mountain streams along the Georgia–North Carolina border. (Type locality: Head waters of Sneaking Creek on Garland Ridge approximately three miles north of Hiawassee, Ga.) A heavy infection is macroscopically evident as a conspicuous white discoloration of the entire musculature of the host and apparently causes death. Mature spores, in life, are somewhat oval in shape, being broadly rounded at both extremities but usually tapering slightly from posterior to anterior. They average approximately 4.6 microns in length and 2.2 microns in greatest breadth. The posterior region of each spore contains a vacuole which typically encloses a tiny granule undergoing Brownian movement. The polar filament is approximately 80 to 90 microns long and tapers slightly throughout its length. The sporont gives rise to eight spores which always become separated as they approach maturity. Eight species of Thelohania in decapod Crustacea have been previously described, six in Europe and two in Louisiana. Only one of the eight, a European form, occurs in crayfish. *T. cambari* differs strikingly from the other forms in having a non-persistent sporont membrane. It also differs significantly in size and shape of the spore. The spore is distinctly larger than that of *T. contejeani* Henneguy and Thélohan in European crayfish.

AMERICAN SOCIETY OF PARASITOLOGISTS

Thirty-Ninth Council Meeting, New York, New York
December 27, 1949

The meeting of the Council of the American Society of Parasitologists was called to order by President T. W. M. Cameron at 8:15 PM, December 27, 1949, in Parlor A of the Hotel Statler, New York. Past-Presidents W. W. Cort, H. W. Stunkard, David H. Wenrich, Henry E. Meleney, Norman R. Stoll and the following members of the Council were present: T. W. M. Cameron, Martin D. Young, John C. Swartzwelder, Paul D. Harwood, Clay G. Huff, George L. Graham and H. W. Brown. G. F. Otto attended.

The regular order of business was taken up.

I. Reports of Officers

1. *Secretary (H. W. Brown):* As of December 1, 1949, there were 713 members of the Society, of whom 628 lived within and 85 outside continental United States. Of these, 46 persons were delinquent for dues for 1949, leaving a net membership in good standing of 589 domestic and 78 foreign, or a total of 667 active members. This is the highest active membership which the Society has had. Seventy-three persons were elected to membership during the calendar year 1949 to December 1, of whom 64 live within and 9 outside continental United States.

William B. Herms, Council Member at Large 1930–1933 and Vice-President of the Society in 1936, passed away this year. The Society has also been informed of the deaths of Mitchel Carroll and Robert C. Rhodes during the latter part of 1948.

The report was accepted and placed on file.

2. *Treasurer (R. M. Stabler):* The Treasurer's report was delayed in the mail and therefore not available until December 28 when it was audited and placed on file. A summary of the Treasurer's report for the fiscal year 1949 (December 1, 1948, to December 1, 1949) follows:

a. The balance on hand as of December 1, 1948, was $4,398.66

b. The collections from all sources to December 1, 1949, amounted to $10,099.97

c. Total funds for the year, therefore, were $14,498.63

d. Total expenditures were $11,700.03

e. Total cash balance as of December 1, 1949, is therefore $2,798.60

The continued rising costs of printing and handling the Journal still constitute the big financial problem of the Society.

Audited and found correct by Auditing Committee:

(Signed) Paul D. Harwood
(Signed) Martin D. Young

II. Reports of Custodians and Committees

1. *Custodian of the Endowment Fund (N. R. Stoll):* The Custodian of the Endowment Fund presented a complete report, including the history of the Princeton Secretarial Fund,* the transfer of the $1,079.45 Princeton Secretarial Fund balance to the present Endowment Fund, and the status of the Endowment Fund at the end of the first fiscal year. The Custodian pointed out that it was hoped the Endowment Fund, aside from being a source of emergency loans of the Society, might permit the Society to underwrite special projects of long-term value and interest. Gifts and bequests to the Fund will be welcomed at any time.

Custodian's report, end of first fiscal year:

Savings bank balance, on transfer	$1,079.45
Interest credited	10.81
Savings bank balance December 14, 1949	1,090.26

Balance on hand was confirmed by the First National Bank of Princeton, New Jersey, December 14, 1949.

The report was accepted, subject to audit, and placed on file.

Audited and found correct by Auditing Committee:

(Signed) Paul D. Harwood
(Signed) Martin D. Young

2. *Chairman of the Editorial Committee (Horace W. Stunkard):* The Chairman reported that the editorial policy had been continued. Increased printing costs for Volume 35 of the Journal were partially offset during 1949 by a generous contribution of $1,000 received from The American Foundation for Tropical Medicine.

* See p. 50.

The report was accepted and placed on file.

3. *Custodian of Back Issues (G. F. Otto):* The Custodian called attention to the fact that sales of back issues were approximately 60 per cent of the preceding year's but nearly 40 per cent above those of the next highest year (1946). During 1949, nine issues of the Journal were duplicated thus completing sets back to and including Volume 14 (1927–28). Plans for microfilming those journals not yet available for sale are being considered by one commercial concern. The Society plans to continue the process of duplication.

The financial report of the Custodian of Back Issues was audited by the Auditing Committee, found to be correct, and placed on file.

4. *Auditing Committee (Paul D. Harwood and Martin D. Young):* The reports of the Treasurer, Custodian of the Endowment Fund, and Custodian of Back Issues were certified to be correct.

The report of the Auditing Committee was accepted.

5. *Committee on Visual Instruction (M. S. Ferguson and W. Malcolm Reid):* No report.

III. Reports of Representatives

1. *To Council of A.A.A.S. (K. C. Kates and A. O. Foster):* No report.

2. *To Governing Board of the American Institute of Biological Sciences (W. W. Cort):* The Society's Representative reported on the expanding activities of the A.I.B.S. The A.I.B.S. now has 15 member societies and 2 affiliates. The report was accepted and placed on file.

3. *To Division of Biology and Agriculture of the National Research Council (N. R. Stoll):* The Society's Representative reported on the meeting of the Division held at Washington, D. C., May 5, 1949. The report was accepted and placed on file.

IV. Old Business

Recommendation made by H. J. Van Cleave that the Committees on Avian Malaria and on Common Names be discontinued was reconsidered by the Council. The recommendation was referred back to the Council at the Thirty-Seventh Council Meeting, December 29, 1947.

The Council voted that the Committees should continue and be constituted as follows: Committee on Avian Malaria: Clay G. Huff, George H. Boyd, Reginald D. Manwell. Committee on Common Names: Paul D. Harwood, J. R. Christie, Donald B. McMullen.

V. New Business

1. *Election of New Members:* Twelve applicants were elected by the Council to active membership in the Society.

2. *Place of Meeting in 1950:* It was voted that the Society meet with the A.A.A.S. in Cleveland in late December, 1950. It was voted to consider meeting with the National Malaria Society, American Society of Tropical Medicine, and the American Academy of Tropical Medicine in 1951 if the meeting is centrally located.

3. The petition of the Zoological Society of London for aid from the Society in the publication of the Zoological Record was tabled.

4. A letter from the Gorgas Hall of Fame Committee requesting the Society's formal endorsement of the inscription of the name of Dr. William Crawford Gorgas in the New York University Hall of Fame for Great Americans was presented to the Council. The Council voted unanimously in favor of this endorsement and instructed the Secretary to write a letter to the Gorgas Hall of Fame Committee confirming the Society's endorsement.

5. The Council unanimously approved: a. The acceptance of the Society of General Physiologists as a member society of the American Institute of Biological Sciences; b. Changes in the A.I.B.S. constitution outlined to the Council.

The Secretary was instructed to inform the A.I.B.S. of action taken.

6. The petition of Past-President H. J. Van Cleave on behalf of the Conference of Midwestern Parasitologists was presented to the Council. Parasitologists residing in the midwestern states wish recognition as a branch or as a regional group of A.S.P., to be known as a "Conference of Midwestern Parasitologists." The group proposes to cooperate in every way with A.S.P.

The Council considered the petition and indicated that they were in sympathy with the aims of this group; however, since the Society constitution makes no provision for the establishment of associate member groups, no action was taken.

7. *Nominations, Elections, and Appointments to Society Offices:*

a. *Nominations:* The following persons were nominated by the Council for the designated offices in the Society for 1950:

President, Willard H. Wright; Vice-President, H. W. Manter; Secretary, H. W. Brown (term runs through 1951); Council Members at Large, J. C. Swartzwelder and George W. Wharton (terms run through 1953)

b. *New Editorial Board Members:* W. W. Cort, John T. Lucker, Cornelius B. Philip
c. *Re-appointed Representatives on Council of A.A.A.S.:* A. O. Foster and K. C. Kates
d. *Nominated for Honorary Foreign Members:* The names of three men were proposed; however, since the Society already has its constitutional limit of 12 Honorary Foreign Members, no further action was taken.

The Council voted to adjourn at 11:05 PM.

Respectfully submitted,
H. W. Brown, Secretary

THE ENDOWMENT FUND

of the

AMERICAN SOCIETY OF PARASITOLOGISTS

History. Since its first year a routine expenditure of the Society has been for clerical and stenographic assistance in the office of the secretary and treasurer. During 1930–32, when the combined office was at Princeton, this assistance was contributed to the Society through interpretation by the administration of The Rockefeller Institute for Medical Research that some activity of its staff in the responsibilities of their professional organizations was fair. Consequently during those three years I segregated $240.00 into a separate interest-bearing account, as funds that would have been otherwise, and properly, expended. This was the beginning of the so-called Princeton Secretarial Fund, for which annual reports—with annual audits—have been made to the Council and Society.

During the depression and again in 1942 loans to a total of $550.00 from the Fund were made to the Treasurer of the Society, and repaid in course by Treasurers Justin Andrews and L. E. Rozeboom. After the depression the Fund became the beneficiary of certain of the Society's frozen assets. These were liquidated over an eight-year period and augmented the Fund by $314.80. During the five-year secretaryship of my successor, H. W. Stunkard, his office made contributions of $284.61 to the Fund, for reasons similar to those by which the Fund was begun. In the approximately nineteen years from 26 March 1930, when the first deposit was made, to 15 November 1948, as the end of its final fiscal year, the Fund had earned $240.04 interest, of which $125.00 was interest on a United States Savings Bond purchased July 1935 and maturing July 1945.

More or less from the beginning of the period under discussion there had been in the minds of a number of us the idea that it would be well for the Society to have an Endowment Fund. Not only would it permit rescue of the ordinary budget by loans during periods of emergency—as the Princeton Fund has already done—but eventually permit the Society to undertake underwriting special projects of long-term value and interest. As you doubtless know, the Society is incorporated. It was further hoped that once the Society had demonstrated it could husband an endowment backlog and not expend it capriciously, it would, as a corporation, attract gifts and bequests from public spirited persons who had an interest in the development of so intriguing and far-reaching a field as parasitology. Up to now no such gifts or bequests have been received, but it should be promulgated that we are open to receive them, for Council and Society have now officially established THE ENDOWMENT FUND, using as a nucleus the nineteen year old Princeton Secretarial Fund.

The official actions were:

1. At the 16th Annual Meeting, Philadelphia, 31 December 1940, the following amendment to the Constitution was adopted by unanimous vote (J.P. 1941, *27*, 277; see also J.P. Dec. 1949, Section 2).

> Endowment Fund. Provision is made for the establishment of a permanent Endowment Fund, the principal of which may be expended only by a three-fourths vote of all members of the Council and approval by a three-fourths vote of the members of the Society present at a regular meeting. The Council shall be entrusted with the maintenance of the Fund, and the use of the income therefrom.

2. Council at its meeting on 20 December 1940, in anticipation of the constitutional amendment, passed the following By-Law (J.P. 1941, *27*, 276; see also J.P. Dec. 1949, Section 2).

> Council shall be entrusted with the maintenance of the Fund, and the use of the income therefrom.

3. Council at its meeting on 20 December 1940, in anticipation of the constitutional amendment, passed the following By-Law (J.P. 1941, *27*, 276; see also J.P. Dec. 1949, Section 2).

> Council shall select a Custodian of the Endowment Fund and two associates, to whom it may delegate responsibility for management of the Fund. The Custodian shall make an annual accounting to Council and such other reports as Council may request. The approval of two of the three custodians shall be necessary for the purchase, sale or exchange of securi-

ties. One of these custodians shall be the Treasurer of the Society and his signature shall be required on all vouchers of expenditure from the Fund.

4. Council at its New Orleans meeting on 6 December 1948 (J.P. Dec. 1949, Section 2) voted to transfer the $1,079.45 in the Princeton secretarial Fund to the Endowment Fund, and elected as Custodian Norman R. Stoll, and as associates the President and Treasurer of the Society.

5. Custodian's report end of first fiscal year:

Savings bank balance, on transfer	$1,079.45
Interest credited	10.81
Savings bank balance 14 December 1949	$1,090.26

Norman R. Stoll, Custodian,
The Endowment Fund of the American Society of Parasitologists.

TWENTY-FOURTH ANNUAL GENERAL BUSINESS MEETING DECEMBER 28, 1949

The general business meeting of the Society was called to order by T. W. M. Cameron, the Society's president, at 2 PM, following the annual luncheon in the Hotel Statler, New York. One hundred and fifty-five persons were present.

1. Reports of Officers, Custodians and Committees, and Society Representatives were read and approved.

2. The Society was asked to approve an amendment to the Constitution changing the annual dues from $5 to $6 per year for members and increasing the subscription rate of the Journal to institutional subscribers and non-members from $6 to $7.50 annually beginning January 1, 1950.

The amendment was unanimously approved.

3. It was moved by H. W. Stunkard and seconded by W. W. Cort and unanimously approved by the Society that the Secretary be instructed to write a letter of thanks to The American Foundation for Tropical Medicine for the grant of $1,000 made by that organization to the Society to aid in the publication of the Journal of Parasitology.

4. A motion was made and passed to have the Secretary write a letter of thanks to the local committee and to the cooperating society for the excellent facilities and for the ease with which the meetings were operated.

5. The officers and Council members of the American Society of Parasitologists nominated at the Thirty-Ninth Council meeting were elected to their respective offices.

6. It was announced that the American Society of Parasitologists would meet with the A.A.A.S. in Cleveland in late December, 1950.

The Society voted to adjourn at 3 PM.

Respectfully submitted,
H. W. Brown, Secretary

SOCIETY OFFICERS
AMERICAN SOCIETY OF PARASITOLOGISTS

Officers for 1950

WILLARD H. WRIGHT, National Institutes of Health ..... *President*
H. W. MANTER, University of Nebraska ..... *Vice-President*
HAROLD W. BROWN, Columbia University ..... *Secretary*
ROBERT M. STABLER, Colorado College ..... *Treasurer*

Council Member Ex Officio[1]

HORACE W. STUNKARD, New York University ..... *Chairman, Editorial Committee*

Council Members at Large

(with date of expiration of term)

1953 JOHN C. SWARTZWELDER, Louisiana State University
1953 GEORGE W. WHARTON, Duke University
1952 G. L. GRAHAM, University of Pennsylvania
1952 L. A. SPINDLER, U. S. Bureau of Animal Industry
1951 PAUL D. HARWOOD, Dr. Hess & Clark, Inc.
1951 CLAY G. HUFF, Naval Medical Research Institute
1950 EMMETT W. PRICE, U. S. Bureau of Animal Industry
1950 MARTIN D. YOUNG, U. S. Public Health Service

Representatives of the Society on the Council of the American Association for the Advancement of Science

(2-year terms expire 1951)

AUREL O. FOSTER KENNETH C. KATES

Representative of the Society on the Governing Board of the American Institute of Biological Sciences

W. W. CORT

Editorial Committee of the Journal of Parasitology

HORACE W. STUNKARD, *Chairman* ..... to serve until 1953
WILLIAM A. RILEY ..... to serve until 1953
JUSTIN M. ANDREWS ..... to serve until 1953

Editorial Board of the Journal of Parasitology

1953 WILLIAM W. CORT, Johns Hopkins University
1953 JOHN T. LUCKER, Beltsville Research Center
1953 CORNELIUS B. PHILIP, Rocky Mountain Spotted Fever Laboratory
1952 E. E. BYRD, University of Georgia
1952 WILLIAM L. JELLISON, U. S. Public Health Service
1952 G. ROBERT COATNEY, National Institutes of Health
1951 ELERY R. BECKER, Iowa State College
1951 NORMAN R. STOLL, Rockefeller Institute for Medical Research
1951 GEORGE W. WHARTON, Duke University
1950 RICHARD J. PORTER, University of Michigan
1950 WILLIAM TRAGER, Rockefeller Institute for Medical Research
1950 ARTHUR C. WALTON, Knox College

Custodian of Back Issues

(3-year term expires 1951)

GILBERT F. OTTO

List of Former Officers

	President	*Vice-President*
1925	HENRY B. WARD*	SAMUEL T. DARLING*

[1] Beginning in 1942, the Chairman, Editorial Committee, became ex officio member of Council.
* Deceased.

1926	Charles W. Stiles*	Charles A. Kofoid*
1927	Richard P. Strong*	Edwin Linton*
1928	Charles A. Kofoid*	Robert Hegner*
1929	Nathan A. Cobb*	George R. LaRue
1930	William W. Cort	Ernest Carroll Faust
1931	William A. Riley	Asa C. Chandler
1932	Maurice C. Hall*	William H. Taliaferro
1933	William H. Taliaferro	Fred C. Bishopp
1934	Ernest E. Tyzzer	James E. Ackert
1935	Charles F. Craig	Harley J. Van Cleave
1936	Robert Hegner*	William B. Herms*
1937	George R. LaRue	David H. Wenrich
1938	Fred C. Bishopp	Elery R. Becker
1939	Horace W. Stunkard	Henry E. Meleney
1940	David H. Wenrich	Gotthold Steiner
1941	James E. Ackert	Justin Andrews
1942	Henry E. Meleney	Rudolf W. Glaser*
1943	Henry E. Meleney	Rudolf W. Glaser*
1944	Henry E. Ewing	Benjamin Schwartz
1945	Asa C. Chandler	Donald L. Augustine
1946	Norman R. Stoll	Harold Kirby, Jr.
1947	Harley J. Van Cleave	Clay G. Huff
1948	Ernest Carrol Faust	Cornelius B. Philip
1949	Thomas W. M. Cameron	Willard H. Wright

Secretary-Treasurer

William W. Cort	1925; 1926; 1927; 1928; 1929
Norman R. Stoll	1930; 1931; 1932

Secretary

Horace W. Stunkard	1933–34; 1935–36; 1937
Oliver R. McCoy	1938–39; 1940–41; 1942
James T. Culbertson	1942–43; 1944–45; 1946–47
Harold W. Brown	1948–49; 1950–

Treasurer

Justin Andrews	1933–34; 1935–36
Gilbert F. Otto	1937–38; 1939–40; 1944
L. E. Rozeboom	1941–42; 1943–44
Robert M. Stabler	1945–46; 1947–48; 1949–

Council Members at Large

Paul Bartsch	1925–28	H. E. Ewing	1931–32
Fred C. Bishopp	1925–28; 1929–30	Ernest C. Faust	1931–34; 1938–41
Robert Hegner*	1925–27	John F. Kessel	1932–35
Charles A. Kofoid*	1925	D. H. Wenrich	1932–35; 1936
B. H. Ransom*	1925	H. E. Meleney	1933–36
William A. Riley	1925–26; 1928–30	Norman R. Stoll	1933–36; 1937–47; 48
Charles W. Stiles*	1925; 1929–32	Eloise B. Cram	1934–37
Ernest E. Tyzzer	1925–26	Wilbur A. Sawyer	1934–37
Maurice C. Hall*	1926–29	James E. Ackert	1935–38
Wilson G. Smillie	1926–27	Earl C. O'Roke	1936–39
Henry B. Ward*	1926–29	Justin Andrews	1937–40
Franklin D. Barker*	1927–30	Harley J. Van Cleave	1938–41
J. H. St. John*	1927–28	Elery R. Becker	1939–43
W. H. Taliaferro	1928–31	Emmett W. Price	1939–43; 1944–46; 1947–
Asa C. Chandler	1929–30; 1936–39	Clay G. Huff	1940–43; 1944–46; 1948–
W. B. Herms*	1930–33	Horace W. Stunkard	1940–43
Benjamin Schwartz	1930–33	Donald L. Augustine	1941–44
L. R. Cleveland	1931	Raymond M. Cable	1942–45
W. W. Cort	1931–34; 1935–38	Gilbert F. Otto	1942–44; 1945–48

* Deceased.

Willard H. Wright	1942–45; 1946–48
Harold W. Brown	1944–47
Harold W. Manter	1944–46
G. Robert Coatney	1945–48
T. W. M. Cameron	1946–48
Martin D. Young	1947–
Cornelius B. Philip	1947
Paul D. Harwood	1948–
John C. Swartzwelder	1949–
James T. Culbertson	1949
G. L. Graham	1949–
L. A. Spindler	1949–
George W. Wharton	1950–

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Robert Hegner*	1932–34
Francis M. Root*	1932–34
Norman R. Stoll, *Chairman*	1938–42; 1943
Horace W. Stunkard, *Chairman*	1944–47; 1949–
William A. Riley	1934–37; 1938–42; 1943; 1944–48; 1949–
William H. Taliaferro	1934–37; 1938–42; 1943
David H. Wenrich	1944–48
Justin M. Andrews	1949–

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William A. Riley	1932–34
W. H. Taliaferro	1932–34
James E. Ackert	1932–35
Richard P. Strong*	1932–35; 1936–39
Fred C. Bishopp	1932–36
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David H. Wenrich	1932–36; 1938–41
Ernest C. Faust	1933–37
Benjamin Schwartz	1933–37; 1938–41; 1942–45
Elery R. Becker	1934–35; 1936–39; 1948
Robert Matheson	1935–38
Oliver R. McCoy	1936–39
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John F. Kessel	1937–40
Harley J. Van Cleave	1937–40
William W. Cort	1938–41; 1942–45; 1946–49; 1950–
Cornelius B. Philip	1939–42; 1950–
Ernest E. Tyzzer	1939–42
Harold W. Brown	1940–43
Harold W. Manter	1940–43
Reginald D. Manwell	1940–43
Richard P. Hall	1941–44
E. Harold Hinman	1941–44
Justus F. Muller	1941–44
Harold Kirby	1942–45
Benjamin G. Chitwood	1943–46
Pincus P. Levine	1943–46
Rudolf Glaser*	1943–46
Lowell T. Coggeshall	1944–47
John T. Lucker	1944–47; 1950
Norman R. Stoll	1944–47; 1948
William L. Jellison	1945–48; 1949
Charles W. Rees	1945–48
Lloyd A. Spindler	1945–48
Raymond M. Cable	1946–49
Lloyd E. Rozeboom	1946–49
Richard J. Porter	1947
William Trager	1947
Arthur C. Walton	1947
George W. Wharton	1948
E. E. Byrd	1949
G. Robert Coatney	1949

List of Meeting Places

1925 Kansas City	1933 Boston	1941 Dallas
1926 Philadelphia	1934 Pittsburgh	1942 (New York, cancelled)
1927 Nashville	1935 St. Louis	1943 (No meeting)
1928 New York	1936 Atlantic City	1944 Cleveland
1929 Des Moines	1937 Indianapolis	1945 St. Louis
1930 Cleveland	1938 Richmond	1946 Boston
1931 New Orleans	1939 Columbus	1947 Chicago
1932 Atlantic City	1940 Philadelphia	1948 New Orleans
		1949 New York

* Deceased.

IN MEMORIAM

BANNER BILL MORGAN

AMERICAN SOCIETY OF PARASITOLOGISTS

LIST OF MEMBERS ELECTED

Since November 1, 1949[1]

BABERO, BERT B., B.S., M.S., Box 960, U. S. Public Health Service, Anchorage, Alaska.
BANKS, WILLIAM, A.B., M.A., 917 River Road Dormitories, Columbus, Ohio.
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LEVINSON, MARVIN, L., B.S., 3452 W. Ainslie Street, Chicago 25, Illinois.
LIGENZOWSKI, FRANK L., B.A., 148 Major Street, Clifton, New Jersey.
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[1] To November 1, 1950. Members elected between October 1, 1948 and November 1, 1949 are listed in vol. 35 (supplement) : 51; members elected between November 1, 1947 and October 1, 1948 are listed in vol. 34 (supplement) : 43; the last preceding list of members was published in the Journal (1947) vol. 33 (supplement) : 35.

McGuire, Willis C., A.B., M.S., 502 Illinois Street, Charles City, Iowa.
McMillan, Rosamond, Division of Biological Sciences, University of Illinois, Undergraduate Division, Room 41, Navy Pier, Chicago 11, Illinois.
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Taylor, D. Jane, B.A., M.S., Laboratory of Tropical Diseases, National Institutes of Health, Bethesda 14, Maryland.
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Tugwell, Robert L., B.S., M.S., Poultry Department, College of Agriculture, University of Tennessee, Knoxville, Tennessee.
Tyrol, Arthur G., Jr., B.A., 110 Havemeyer Place, Greenwich, Connecticut.
Warren, Bruce, B.A., University of Minnesota, Zoology Department, Minneapolis, Minnesota.
Yoshimura, Tama, B.S., 1050 North LaSalle Street, Chicago 10, Illinois.